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ROTUNDA

the magazine of the Royal Ontario Museum

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ROTUNDA

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Volume 15, Number 3, Fall 1982

Editorial: Beyond the Galleries 2

Toronto's Musical Past—A Footnote 4
Ladislav Cselenyi

"All Kinds of Musick": A quintet of unusual musical instruments 5
Alice Chrysler

The Christmas Star: Miracle, myth, or scientific fact? 12
John Kenny

Before the Argo: Bronze Age ships of the Mediterranean 18
N. B. Millet

The Growing Collections 30

Recent Publications 32

Bronze Sculpture in Miniature: Baroque medals of Massimiliano Soldani-Benzi 33
K. Corey Keeble

Gallery Glimpses 38

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Cover: The once fierce *Allosaurus* and the other dinosaurs are ready to be seen by their admirers again in their old location on the second floor of the ROM (see page 39). Photo: Bill Robertson, ROM.

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Editorial
Beyond the Galleries

"What do you do?"

"I work at the Royal Ontario Museum."

"Oh—I guess you people don't have much to do just now, eh?"

At first I assumed that the remark was meant ironically, but instead of joining in my polite if rather mirthless laugh, the speaker merely looked defensive.

"Well, I mean—you *are* closed, aren't you?"

As most of us were to discover sooner or later, the speaker was not alone in his misapprehension that once the Museum's main building had closed its doors, the premises were simply handed over to architects and contractors, while the staff had nothing much to do except put their collective feet up until it was all over and they could get on with their jobs again.

Nothing, as we have good reason to know, could be further from the truth. The Canadiana galleries in the Sigmund Samuel building and the Star Theatre in the Planetarium, of course, never did close; and by virtue of that very fact they tended to seem like islands of relative calm and order in the midst of bedlam. For most of the Museum's staff, the period of closure has been a time of activity more strenuous and unremitting than anything likely to be experienced during normal Museum operations. The planning, design, and construction of completely new galleries embodying all that is most innovative and imaginative in modern museum practice; the packing, removal, and storage of millions of artifacts and specimens prior to their redeployment in their new environments, with all the attendant problems of conservation, registration, and security; the relocation and re-equipment of all offices and laboratories and physical facilities—all of it having to be accomplished while the building itself was literally being rebuilt around us—these were tasks of a magnitude and complexity that seem even more awesome in retrospect than they did in prospect.

But this was only one aspect of the activity. In the midst of it all, the staff continued to carry out all those many and varied functions of the Museum that take place outside the public galleries. Field work continued to be done, research was carried out, books were written, university courses were taught, public lectures were delivered, and all those multifarious services that Museum experts customarily undertake for government, industry, and the public at large were performed much as usual. Meanwhile the work of those departments that function mainly in a support role knew no let-up (indeed, in some respects it noticeably increased). The flow of information to the media, the membership, and the general public was unabated; publications were produced; memberships were serviced; personnel services were maintained; the accounts were kept. During the whole period of closure, the only department whose activities were temporarily suspended was the Museum shops.

It has been a strange and in many ways a challenging time, and it has shown once again that even in adverse circumstances there is oppor-

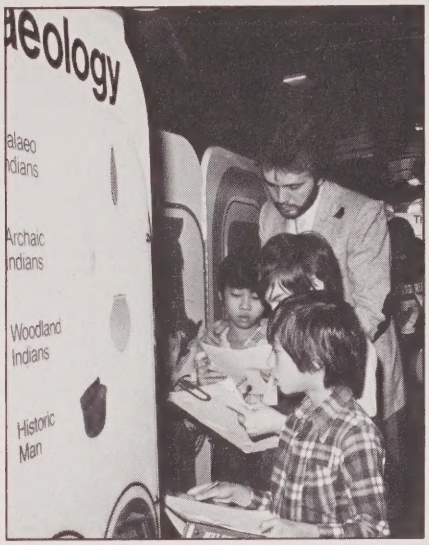
Below: T. Cuyler Young, Jr., director of the Canadian Archaeological Expedition to Iraq, supervising workmen at Yimneyeh, the 9th-century B.C. Neo-Assyrian fortification on the middle Euphrates.

ROBERT HENRICKSON, ROM.

tunity. The period of closure has indeed proved an ideal opportunity for directing attention to the fact that, essential as galleries are, the activities of the Museum do not begin and end there, nor do the galleries constitute the only avenue of communication between the ROM and its public. Though exhibits could not be displayed in the galleries, Extension Services continued to send out travelling exhibits to all parts of the province. While we have had no exhibition hall of our own, loans of Museum artifacts have gone out, as usual, for display in the exhibitions of other institutions. (Particularly noteworthy among these were loans of materials to our two sister institutions: to the Art Gallery of Ontario for the exhibition "Arts of Italy in Toronto Collections" and to the Ontario Science Centre for "China: 7000 Years of Discovery".) When school classes could no longer be conducted in the galleries, teachers from Education Services took artifacts to the schools and held their classes there. Closure has caused no diminution in the programmes of talks, lectures, and films offered to the public, and the Speakers' Bureau has continued to send out its lecturers, upon invitation, to a wide variety of groups in communities large and small throughout the province.

Although—as in the case of school classes—the special circumstances of closure have occasionally necessitated adaptations, none of these programmes has been called into existence simply to fill the gap left by the temporary absence of galleries. All have been in operation year in year out as part of the Museum's total response to its mandate. For nearly two years they have had to sustain by themselves the task of communicating with the public, and if this has had the effect of bringing them into the spotlight, such prominence is well merited and all to the good. Now that the galleries are opening again, the value of these programmes as a complement to the displays and exhibitions of the ROM's and visiting collections will be even more evident and more keenly appreciated.

J.S.C.



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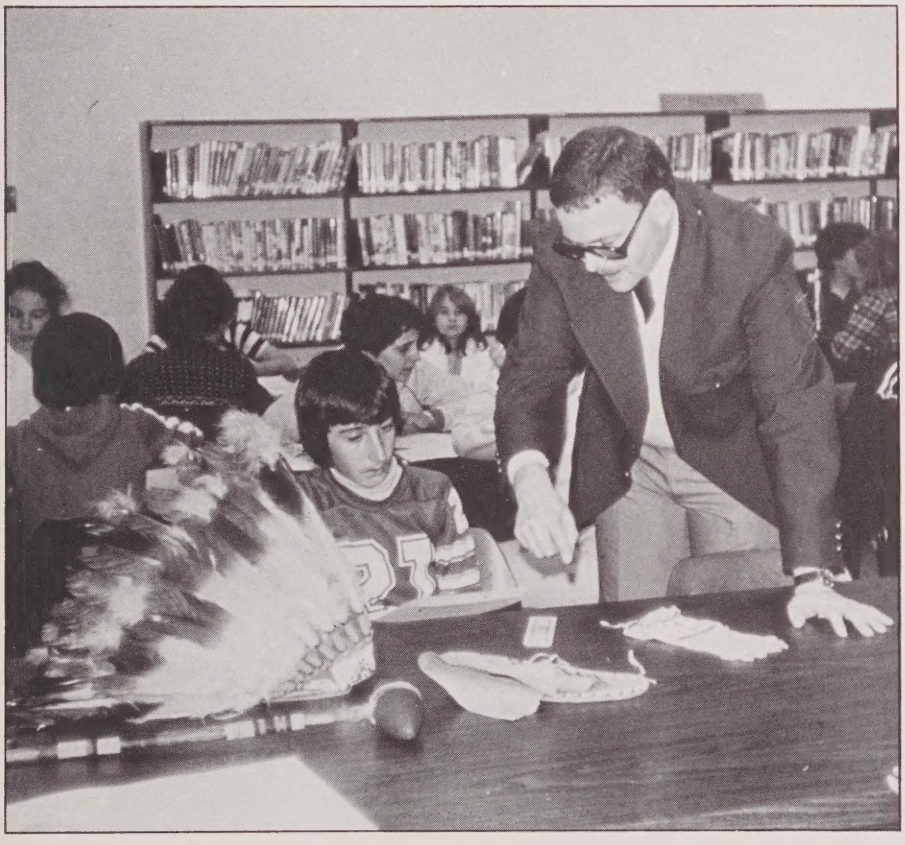


Above (upper): The Man in Ontario museumobile serves as a classroom for upper elementary students. Two ROM museumobiles travel throughout the province visiting schools in the spring and fall, and libraries, provincial parks, and sites of special events in the summer.

Above (lower): Archie Foss, head of Education Services, and Anker Odum, an artist in Exhibit Design Services, prepare a travelling exhibit on amphibians for touring in Ontario.

Left: Arthur Jamieson, a teacher in Education Services, teaches a Grade 7 class at Cosburn Junior High School, Toronto, about the Native people of Canada.

Toronto's Musical Past–a Footnote

Ladislav Cselenyi
Associate Curator
European Department

SEVENTH SEASON . . . 1912-13

SECOND PROGRAMME

Soloist: MME. ALMA GLUCK—Soprano

1. Peter Iljitch Tschaikovski - Symphony No. 4, in F minor (Op. 36)
(Second time at these concerts; last performed March 27, 1912)
I. Andante sostenuto—Moderato con anima.
II. Andantino in modo di canzona.
III. Scherzo, "Pizzicato ostinato," Allegro.
IV. Finale: Allegro con fuoco.

2. Wolfgang Mozart - - - - - - - Aria: "Il re pastore"
MADAME GLUCK AND ORCHESTRA

3. (a) Coleridge Taylor - - - - - - - - - - Waltz
(b) Leo Delibes - - - - - - - - - - - Pizzicato
(c) Ernest Gillet - - - - - - - - - - "Loin du Bal"

4. (a) N. Rimsky-Korsakoff - Chanson Indoue, from the Legend "Sadko"
(b) Felix Weingartner - - - - - - - - - Liebesfeir
(c) Lola Carrier Worrell - - - - - - - - - Chimes
(d) A. Rosenstein - - - - - "The Disdainful Shepherdess"
MADAME GLUCK
(At the Piano: Mr. Arthur Rosenstein)

By request, MADAME GLUCK has consented to sing as an extra number:—

Fernand-Levaux - - - - - - - - - - "Le Nil"
(Violin Obligato by MR. BLACHFORD)

5. Carl Goldmark - - - - - - Overture "Sakuntala"
(First time at these concerts)

GOD SAVE THE KING

NEW SCALE WILLIAMS PIANO USED.

29

COURTESY OF MRS. JANE McCORMICK

The opening of the Roy Thomson Hall, the new home of the Toronto Symphony Orchestra, on 13 September 1982, almost simultaneously with the reopening of the Royal Ontario Museum, is a fitting occasion for recalling what both the TSO and the Museum owe to the Williams family of Toronto. The R.S. Williams collection of musical instruments was one of the first major gifts to the ROM when it opened seventy years ago. This splendid acquisition brought the Museum into direct association with one of the foremost families of the musical instrument industry in Canada, and one that has added greatly to the development of the country's musical culture.

The Toronto Symphony Orchestra accorded R.S. William's instruments signal recognition when it adopted concert grand pianos made by the Williams Piano Co. Ltd. for use in its performances. A page from the second programme of the Orchestra's seventh season (1912–13), reproduced here, announces the use of the "New Scale Williams Piano". In the same programme, the list of "Guarantors of the Orchestra" includes both Messrs. Williams Piano Co. Ltd. and Messrs. R.S. Williams & Sons Co.

During research on the Williams family, the Museum acquired an interesting photograph showing the renowned concert violinist Mischa Elman (second from left) with his father and sister visiting R. S. Williams (right) in his office about 1920. Ten years earlier Mischa Elman had been soloist with the Toronto Symphony Orchestra for two seasons. According to the *Toronto World* of 1 May 1910, when Elman arrived in Toronto for his second concert at Massey Hall, the first thing he did was to seek out the only Canadian expert on old violins and violin bows. After the two had spent a few days together, R. S. Williams, with his customary generosity, presented the young virtuoso with the Vuillaume bow which Elman, as he said at the time, regarded as the most valuable in existence.

Now is an appropriate time, as two of Toronto's most famous institutions, the Toronto Symphony Orchestra and the Royal Ontario Museum, find themselves in modern, improved environments, to remember the many benefactors, who have contributed to Toronto's cultural vitality.

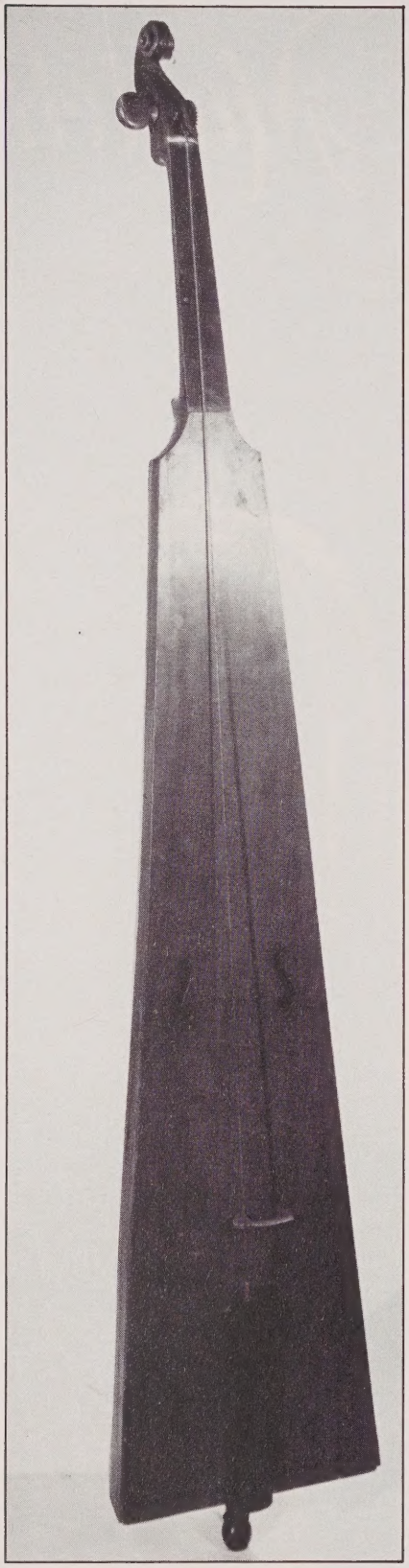
COURTESY OF MRS. I.W. BROCK

All Kinds of Musick

A quintet of unusual musical instruments

Alice Chrysler

These are the graceful curves of the early church serpent. Military serpents were heavier and more compact, often with several keys.



ROM PHOTOGRAPHY DEPT.

Above: German tromba marina, 17th century

"The instrument produces a more nearly agreeable tone at a distance than it does close at hand . . ." This less-than-complimentary 16th-century description of the tromba marina by a Swiss monk named Glareanus might suggest that the instrument should be seen but not heard. But our curiosity about any instrument cannot be satisfied by merely looking at it. We can appreciate its personality only by knowing how it is played and what it sounds like, however painful the experience may be. As a teacher at the ROM and the owner of a number of unusual instruments, I have had the fun of helping to whet and satisfy the curiosity of students both in the gallery and, recently, in more than fifty schools that have requested the music programme for their classrooms during the Museum's closure.

The tromba marina (trumpet marine) consists of a single ropelike string stretched over a long, tapering, wooden sound box. The wider end of the box rests on the ground, the tapered end on the player's shoulder. Under the string is a bridge, adjusted so that one of its feet is free to vibrate against the wood of the sound box, or against a metal or ivory plate set into the wood. One might expect a string-bass sound, but the unique method of playing produces something very different. Whereas a violin player presses the strings firmly against a wooden fingerboard, tromba marina playing involves only gentle contact, usually of the left thumb, with the string; this produces a series of harmonics very much like the notes of the natural (valveless) trumpet. The bow, unlike the violin bow, is applied to the short section of the string, that is, the part above the player's left hand. The combination of the high-pitched harmonics and the rattling of the bridge, amplified by the resonance of the large sound box, gives point to Glareanus's complaint. I have heard only a recording of the tromba marina, but the blatant brassy tone justifies the "tromba" element of the name.

"Marina" remains a mystery. Was the instrument invented by a man named Marinus, or could it have been used for signalling at sea? The alternative German names *Marientrompette* and *Nonengeige* (nun's fiddle) hint at the use of the tromba marina in convent orchestras, since nuns were not allowed to play trumpets; but musicologists remain dubious.

The tromba marina may have its origin in the monochord, a device used for centuries in physics laboratories to teach the science of sound. The monochord consists of a calibrated sound box with one string and a movable bridge, with which the fixed intervals of the musical scale can be calculated and demonstrated. The performing version, now in the shape of the tromba marina, is first pictured in 12th-century French sculpture, enjoyed its heyday in Europe in the 15th century, and reached England by the 17th century. Samuel Pepys reported in 1667 that the tromba marina "do so far outdo a trumpet as nothing more". Pepys, like Glareanus, probably heard the instrument played by wandering street musicians, who could hardly have extracted from its limited possibilities much more than simple fanfares. In convents it may have been used to provide a dronelike accompaniment to religious chant.

In spite of variations in shape, size, playing position, and number of strings, three features distinguish the tromba marina from any other instrument: the light thumb contact, the bowing position, and the vibrating or drumming bridge.

The hurdy-gurdy is another instrument that amazes both eye and ear. It is a stringed instrument, with a body resembling that of a lute or a guitar. (Lutes and guitars were sometimes converted to hurdy-gurdies.) The most unusual feature of its appearance is a handle or crank projecting from the end opposite the tuning pegs. The crank, operated by the player's right hand, rotates a wooden wheel, whose rim, covered with rosin, rubs against the underside of the strings and causes them to vibrate. Thus the wheel replaces a bow. Since the 16th century most hurdy-gurdies have had six strings, but only two go through the keybox. The others are drones *(bourdons)*, able to sound only the octaves, fourths, or fifths to which they are tuned. Hence the ear's surprise—because of the drones the hurdy-gurdy sounds remarkably like bagpipes. A skilled player can turn the crank in a deliberately jerky way so as to articulate the rhythm of

G.M. STUDIOS

Above: The tromba marina player bows the string *above* the left hand.

Left: A late 18th-century French hurdy-gurdy with guitar-shaped soundbox.

GORDON MILLING

Above: A marching band of hurdy-gurdy players in Auray, France.

the music. This effect cannot be duplicated on bagpipes because the bagpipe player cannot leave momentary silences between notes.

The hurdy-gurdy's two melody strings *(chanterelles)* are tuned in unison, and the keys stop (that is, press against) them both at the same place so that both play the same note. One of the drone strings *(trompette)* passes over a movable bridge, like the tromba marina's, which can be set drumming at the wish of the player. Another special effect is the buzzing of the *mouche* (fly) drone, appropriately named since it sounds like a fly caught behind a screen. The drones can be disengaged from the wheel if the player chooses not to use all four at once.

According to representations in 12th-century sculpture, the early hurdy-gurdy (called the organistrum) required two players because of its complicated key action. The keys were connected to rotating bridges and had to turned "on" and "off". Thus one player was kept busy flipping keys from side to side with both hands, while the other had a rather leisurely one-handed job of cranking. By the 13th century, simple sliding keys enabled one player to manage both operations, even after the range of notes was extended to two octaves. Except for some recent instruments to whose keys springs have been added, hurdy-gurdies must be held on a slant so that the keys, when released, will drop away from the strings by gravity.

The name hurdy-gurdy, used in England since the 16th century, may possibly be derived from the Scandinavian term *gøre*, meaning "confused noise", but it's more likely that it is simply imitative of the instrument's sound. A different

kind of confusion arises when the name is applied to any instrument played with a crank, for example, the organ-grinder's mechanical organ or the little music-box mechanisms sold in novelty stores in the last few years. The French name *vielle à roue* (fiddle with wheel) is perhaps the most descriptive of the many names the instrument has acquired throughout Europe over some thousand years. The German name *Leier* may remind some readers of Schubert's melancholy song "Der Leiermann" (the hurdy-gurdy man). The song, with its dronelike piano accompaniment, tells of a lonely beggar playing on the frozen river beyond the town, an outcast from society.

The hurdy-gurdy has been an instrument of the church (in very early times), of street musicians, of beggars and, in contrast, of fashionable and idle members of the French court in the years up to the French Revolution. Mozart wrote minuets and German dances for it. Haydn left several works for two hurdy-gurdies and string orchestra. It has survived periods of unpopularity to emerge again in the mid-20th century as a folk instrument, especially in France. Cousins of mine recently heard and photographed a band of young teen-aged girls in plaid skirts, playing hurdy-gurdies in a village celebration in Brittany. The instrument also has uses that go beyond the musical. I have heard of a French porcelain, probably of the bergère period, depicting a young man sitting on a bench very close to a young woman, so that his right arm can reach around her to turn the crank of the hurdy-gurdy lying on his lap.

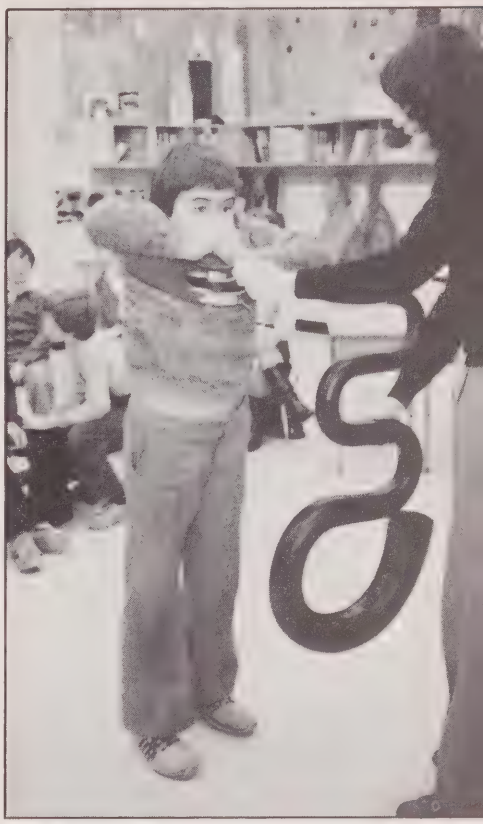
The hurdy-gurdy is a mechanical violin, doing away with most of the difficulty, and most of the sensitivity, of the violin. But a vigorous player, using some or all of the instrument's special effects, can produce a harsh, rasping, rhythmical, and exciting sound, likely to set tapping the most sluggish foot.

What sounds like a trombone, has fingerholes like a flute, and looks like a creature from the Garden of Eden? The answer is the "serpent", an instrument invented in 1590, so we are told, very popular in 18th-century France, and played today mostly by specialists in old instruments. Though unable to claim the thousand-year history of the hurdy-gurdy, the serpent has made its mark. It held an important position in the church as accompaniment to plainsong, served in the bass section of European military bands, and appeared in several of Thomas Hardy's 19th-century village bands. It even attracted the attention of such respectable composers as Handel, Mendelssohn, and Wagner, and it still has a devoted, if small, following today.

Like other members of the cornett (not to be confused with cornet) family, the serpent is made of wood carved into two halves longitudinally, glued together, and covered with black leather. The result is a serpentine wooden tube, approximately 2.5 m long, with a diameter of 10 cm at the wider (lower) end. The length is increased by a brass tube fitted into the narrow upper end. My serpent is beautifully made: the two halves match perfectly along the 5 m of glued seams, and the leather has been applied so skilfully that it looks as if it were "grown" on purpose to fit. The leather helps secure the glued edges, for serpents predate modern epoxy adhesives.

The serpent is played by lip vibration against a cup-shaped mouthpiece. In an ensemble its tone tends to get lost between the trombone and the bassoon; on its own it is rich, rather woody, and very pleasant except for some uncertainty of pitch. Because the fingerholes are placed where they are convenient to reach rather than where they are acoustically correct, almost every note must be adjusted by lip control. Some notes are theoretically impossible on the keyless serpent and must be "lipped" up or down from the adjacent note. To hit one of these notes in a fast passage requires great skill.

Among present-day enthusiasts Christopher Monk's London Serpent Trio should be mentioned. Mr. Monk, who lives in a farmhouse in Surrey, England, not only plays but makes serpents and their smaller serpentine relatives called lizards. An instrument with the name and appearance of a serpent is bound to be the subject of many jokes, and it is hard to take seriously the possibility of three players performing together harmoniously and melodiously. But they succeed, ending their programmes with a stirring rendition of "Rule Britannia".



ALICE CHRYSLER, ROM

Above: A student in Mrs. Crawford's class at Shaw Public School, Toronto takes his turn at the serpent.

ROM PHOTOGRAPHY DEPT.

Above: Detail of the pegbox of the "Tieffenbrucker" violin. According to the label on the inside, Tieffenbrucker must have risen from the grave to create this instrument. However, it is now attributed to J. B. Vuillaume.

IAN COOK/PEOPLE WEEKLY/ © 1979 TIME INC.

Right: Christopher Monk, of the London Serpent Trio, outside his home in Surrey with some of his creations.

Quite different are the honks and groans that emerge from my Museum music classes. The students all line up for their turn at the serpent, after being instructed to "make a rude noise" with their lips. They catch on quickly to the rude noise, but refining it into real music would require months of practice. The students find the serpent's appearance intriguing, and each other's struggles with it hilarious. The instrument's most unexpected success was at the Canadian National Institute for the Blind with the Hand Highway Club whose members have impairment both of sight and hearing. They ran their hands over its sinuous curves and held on to it to sense the vibrations when it was played, thoroughly enjoying something they could neither see nor hear.

Violins are familiar instruments to most of us, but there is quite a story behind one in the ROM's collection. Instead of the usual fiddlehead scroll, the top of the pegbox is in the form of the carved head of a dignified bearded man. The back of the violin is decorated with a picture of a medieval city inlaid in ornamental woods. Carved all the way around the instrument's ribs is a much abbreviated Latin inscription, which can be translated: "I was alive in the wood. I was cut down by the cruel axe. In life I was silent, in death I sing sweetly." The carving, inlay, and inscription are all characteristic of violins made by Caspar Tieffenbrucker (1515?–1570), the most important member of a large Bavarian family of instrument makers. With the aid of a flashlight it is possible to read the label through the f-hole: "Gaspard Duffaprugard, 1697". This is a well-known variant of the spelling of Tieffenbrucker's name; but did he rise from his grave after 133 years to create one more masterpiece? Another "original" Tieffenbrucker is dated 1515, surely a little early in life for even the most precocious child to be turning out high-class violins. Even experts have been confused

ALICE CHRYSLER, ROM

until recently by these violins, which were actually made in France in the 1820s by Jean Baptiste Vuillaume. Perhaps Vuillaume enjoyed the challenge of striving to duplicate the excellence of his illustrious predecessor's craftsmanship; his carelessness with dates suggests that he was not guilty of attempting serious fraud. Fortunately his violins are good ones and have inspired lesser makers to copy *his* Tieffenbrucker copies. (One was on display in a Bloor Street shop recently.)

Very appealing to young students is our exhibit of kits or pocket violins (French *pochette*). These are tiny violins with fingerboards elongated to accommodate the adult hand of the 18th-century itinerant dancing teacher. The teacher could scratch out a rhythmic tune for the dancing lesson, high-pitched but (perhaps mercifully) not very loud. Then he could shove the tiny instrument into its cylindrical leather case and carry it easily in a coat pocket as he trudged on to the next student's home. Kits seem to have survived well—museums often have large collections of them. Perhaps this is because they are usually very attractively decorated, and, being small, are relatively easy to care for, store, and hand down from generation to generation.

The five instruments I have chosen to write about are a very small selection from the ROM's collection, but they are especially interesting to me because of their construction, technique, or history. While most of them have been made obsolete by technological advances or changes in taste, the ingenuity and craftsmanship that went into their manufacture are still something to marvel at.®

JOHN WHITTAKER

Alice Chrysler was born in Toronto and received her B.A. from the University of Toronto. She taught a variety of subjects in high schools in Flesherton, Port Perry, and Willowdale, Ontario. Since she joined the ROM staff as a teacher in 1965, she has conducted classes in all the Museum's science galleries as well as in the armour, medieval, and musical instrument galleries. One of her hobbies is music. She has studied piano, violin, and flute, but has always been fascinated by anything on which a musical sound can be produced.

Top, left: The inlaid back of the "Tieffenbrucker" violin.

The Christmas Star

Miracle, myth, or scientific fact?

John Kenny

Right: *The Adoration of the Magi*, A. Dürer (1471–1528), woodcut done before 1506.

The search for an explanation of the star of Bethlehem is almost as old as St. Matthew's Gospel itself, which contains the only Biblical reference to it. St. Mark, the writer of the earliest Gospel, does not mention the Nativity at all. St. John, viewing the event in a different perspective, records simply that "the Word became flesh and dwelt among us". And though St. Luke describes the birth of Jesus, he does nothing to corroborate Matthew's account of celestial phenomena. Instead of wise men and a star there are shepherds and angels.

Yet the search for the star continues. It has absorbed the attention of theologians, astronomers, and laymen alike. It is a matter fraught with controversy, and even now there is no agreed answer.

It is possible to take Matthew's account at its face value: a star miraculously appeared in the heavens and led the wise men to Jerusalem and on to Jesus' birthplace in Bethlehem. If we accept this account literally, however, we do so as an article of faith rather than as proven historical fact. Alternatively, we may be more inclined to agree with the theologian E. W. Saunders, who wrote in *Jesus in the Gospels*, "We mistake the character of the Gospels and misunderstand the intention of the evangelists when we insist on treating [the Nativity] stories as sober historical-biographical descriptions of the manner of Jesus' entrance into the world."

Considered as an astronomical observation, Matthew's story is bound to raise doubts about its literal accuracy. The behaviour of the star is unusual, to say the least. It rises in the east, leads the wise men westward to Jerusalem, turns south to Bethlehem, and finally comes to rest over the infant Messiah. No known astronomical object could, in any literal sense, behave in this way.

There are many other features of Matthew's story that may raise questions in the mind of the careful and critical reader, particularly one with some knowledge of the history and circumstances of the time. There are apparent inconsistencies both within Matthew's own account and between his account and those of the other evangelists. For Matthew's purpose was not simply to record historical facts—whatever they may have been—but to express his conviction that the Son of God had been born and that in Jesus the Old Testament prophecies of a Messiah had been fulfilled. Much of Matthew's Gospel alludes to the prophetic themes in the Old Testament. This provided a sense of continuity for the Jewish-Christian converts in the early Church. For example, in the Book of Numbers, we read that Balaam, a magus from the east, prophesies that "a star will rise from Jacob" (Num. 24:17). There are also parallels between the early lives of Jesus and Moses. Jesus is portrayed by Matthew as the embodiment of the history of Israel and the culmination of its destiny. Thus the question to be answered was not how Jesus was born, but who he was and why he had come.

How, then, does the story of the star and the magi serve Matthew's purpose? The magi were a priestly caste of Persian mystics. They were astrologers, enchanters, and seers, widely respected and feared for their occult powers. In paying homage to the infant Jesus, they were acknowledging a power higher than their own. In addition, Matthew makes use of the fact that the magi were Gentiles, thus justifying to the Jewish community the presence of Gentiles within the Church.

The significance of the star was in its symbolic and astrological affirmation of Jesus' divine authority. There was a general belief at the time that the birth of great men was marked by unusual celestial occurrences. Moreover the star of Bethlehem could be taken to symbolize Jesus' power not just on earth but throughout all Creation.

It is difficult for us to imagine the influence of astrology in the Hellenistic world. Astrology constituted a sort of divine law, its inexorable rules predetermined by celestial motions. Rather than inspiring hopefulness, it produced a sense of fatalism and futility. But the appearance of the star of Bethlehem announced a new force in the universe and reaffirmed God's dominion over the created order. For Matthew, this was the importance of the star.

But when all this has been recognized, we may still ask ourselves whether there was not perhaps some actual celestial occurrence that Matthew was able

The Christmas Star show at the McLaughlin Planetarium has been an annual event since the Planetarium opened. The current show is the third version of this popular Christmastime event. This year it will be shown from 16 December to 2 January. For more information, call (416) 978-8550.

MOUNT WILSON & PALOMAR OBSERVATORIES

Right: Crab nebula, a supernova remnant of a star that exploded in A.D. 1054. Chinese astronomers recorded that it was bright enough to be seen in daylight.

to use for his symbolic purposes. Biblical scholarship reveals that his Gospel was probably written about A.D. 80, and possibly in Syria where astrologers were active. It may well be that Matthew acquired knowledge of some celestial event that he associated retrospectively with the birth of Jesus, though his description of the event may have been somewhat fanciful.

Almost every kind of phenomenon that appears in the sky has at one time or another been used to explain the star of Bethlehem. Several authors have suggested that the star was a nova. Since the word nova means a new star, such an explanation seems appropriate to the situation. But a nova is really a flare-up of a very old star. It occurs when a hot, dense, white dwarf star is bound in a binary system to a larger, more diffuse star. The gravitational field of the white dwarf pulls material from its partner, causing a layer of nuclear fuel to build up on the surface of the white dwarf until instabilities trigger detonation. The nova then flares up with 100 000 times its former brightness, before dimming once more over a period of a few months and then sinking back into obscurity.

Even more spectacular are supernovae. These occur when the interior of a very massive star becomes critically unstable. The result is the most powerful type of explosion known to occur in the universe. The star literally rips itself apart, releasing a thousand times the energy of a nova. For a brief period a supernova may outshine all the other stars in its galaxy combined.

Novae and supernovae are seen once in twenty-one years, on average, and thus are not exceedingly rare. Ancient Chinese astronomers were very interested in these events and kept track of them, but there is no record of any such bright novae about the time of Jesus' birth; and, astrologically, their interpretation is at best uncertain.

Comets have also been suggested as a possible explanation of the star. Comets are loose balls of dust, ice, and other material left over from the formation of the solar system. They travel in elongated orbits, spending most of their time in the numbing cold of the outer reaches of the solar system. As they approach the sun, they are warmed by its energy, which drives off dust and gas to form a tail. A bright comet can be quite impressive, and comets were certainly significant in astrology. They were, however, held to be omens of death

HANS VEHRENBERG

Left: Comet West on 6 March 1975 at dawn. This spectacular three-minute exposure shows a tail divided into six portions.

and destruction, and it is unlikely that Matthew would base his story on such an inauspicious event.

Then there are meteors. These are small interplanetary rocks, which collide with the earth's atmosphere at speeds of up to 250 000 km per hour. A glowing trail across the sky is produced by the heat generated by the friction with the air. There was a belief that every time a meteor or "shooting star" was seen in the sky, a baby was born on earth. An observer, though, will see, on the average, at least seven meteors an hour every night of the year, and even the brightest of them lasts only a matter of seconds. A meteor just wouldn't be distinctive enough.

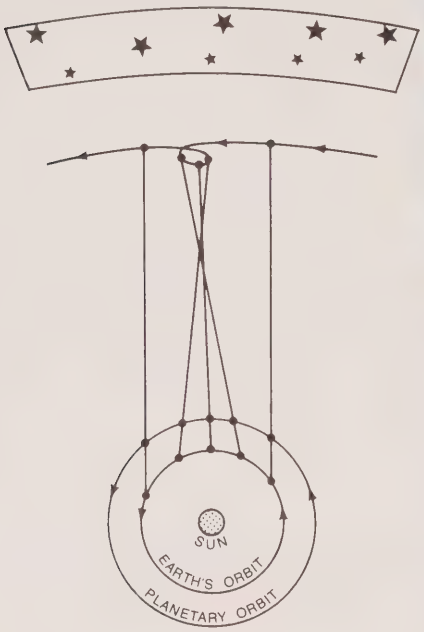
Some authors have suggested that Matthew may have been referring to the phenomenon known as ball lightning. The phenomenon is little understood, but it is thought to consist of a self-contained sphere of electrically charged dust and ionized gas, almost like a bottle of electricity. Ball lightning could certainly move in the way that Matthew describes, but it is relatively short-lived and looks nothing like a star.

It was probably inevitable that some one would suggest that Matthew was describing a UFO or "flying saucer". However, the most widely accepted explanation of the star of Bethlehem involves the planets. Planets are bright, starlike in appearance, and, for astrologers, by far the most significant objects in the sky.

Compared with the stars and the galaxies, the planets are relatively close to us in space. Some like Mercury, are small rocky worlds pitted with craters and having little or no atmosphere. Others, like Jupiter, are enormous worlds com-

Right: A time exposure made in the Munich Planetarium shows the formation of retrograde loops—an apparent motion that happens when the Earth passes inside a superior planet.

DEUTSCHES MUSEUM, MUNCHEN



Above: By following the sight lines from the Earth's orbit to the planetary orbit, you can see how the successive positions of the outer planet appear to describe a loop against the background of the fixed stars.

posed almost entirely of atmosphere with no solid surface of rock. The ancients knew nothing of all this. To them the planets appeared like brilliant stars. Without telescopes the farthest one they could see was Saturn. What distinguishes the planets, to the naked eye, is their motion among the fixed stars as they orbit around the sun. Of the thousands of starlike objects in the sky, only the five visible planets could be seen to move in relation to the others. Night by night they slowly change their positions in the heavens, and because of this they were thought to have special powers. With our present-day knowledge of the motion of the planets we can calculate their position at any moment in history.

To discover whether there could have been any planetary omens at the time of Jesus' birth we have to know when he was born. The twenty-fifth of December was only one of the days on which early Christians celebrated the Nativity. This was the day on which the Romans celebrated the winter solstice, *Dies Natalis Solis Invicti*, decreed a holiday by Aurelius in A.D. 275. This festival took place shortly after the feast of the Saturnalia from which many Christmas customs derive, for example, the exchange of gifts. Christmas was not an important feast until the 4th century. Before this time most celebrations of the birth of Christ, if they were held at all, took place at the same time as Epiphany, 6 January. The celebration was moved to 25 December by Pope Liberius in A.D. 354. Christmas celebrations originated at a time when the sun cult was very strong in Rome and so the twenty-fifth may have been adopted from *Dies Natalis Solis Invicti*. But as to the actual time of year of Jesus' birth there is practically no evidence at all.

Our present system of numbering years was devised by the monk Dionysius Exiguus in A.D. 525. Many systems of numbering were in use at this time but Dionysius wanted a calendar that began with the birth of Christ. When Dionysius came to determine which year corresponded to the year A.D. 1, errors were made. It is now generally agreed that Jesus was born a few years before the year Dionysius designated A.D. 1. It is known that he was born during the last few years of Herod's life and that Herod was dead by the spring of 4 B.C. Luke's mention of a census, together with other evidence, places the probable date of the Nativity between 8 and 5 B.C., with 7–6 B.C. as the most likely time. When we consider the motions of the planets in this period we find one rather important event.

In early 7 B.C. both Jupiter and Saturn were prominent in the sky over Judaea. These are the two most distant planets visible to the naked eye. To astrologers they were both powerful deities. Jupiter was associated with kings and royalty, Saturn with the Hebrews, who celebrate the Sabbath on Saturnsday (Saturday). Because Jupiter is closer to the sun than Saturn, it moves more quickly, overtaking Saturn every twenty years. When one planet passes another in the sky, the event is called a conjunction, and on 7 May 7 B.C. Jupiter was in conjunction with Saturn. This took place in the constellation of Pisces (the Fishes), and there is evidence that Pisces was specially associated with Israel and the lands of the eastern Mediterranean. During the summer the planets moved apart in their orbits, but now strange things began to happen.

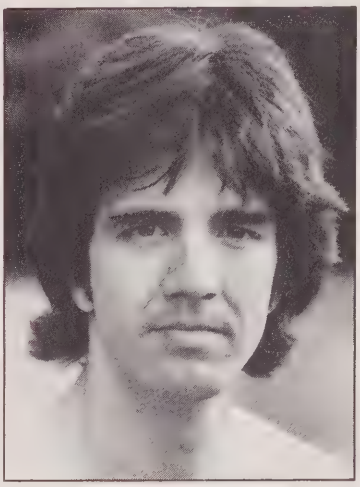
Normally the movement of the planets against the background of the stars is

from west to east. However, when the earth passes between the sun and the outer planets, these planets appear to stop and back up. Of course, they don't really move backwards; it's only a trick of perspective, of the kind that occurs when you pass a slow-moving truck on the highway. The truck moves from in front of you to behind you, but it's not actually in reverse; it's just that you are moving faster than it. This apparent backing up is called retrograde motion.

In July of 7 B.C., when Jupiter and Saturn, as seen from earth, were only a short distance apart in the sky, both began their retrograde motion. On 9 October they were once again in conjunction. This was a most unusual event. Jupiter then moved away from Saturn a second time while the planets were still in retrograde motion. In November they resumed their forward or "direct" motion and a third conjunction took place on 1 December 7 B.C. Jupiter, the planet of kings, had met with Saturn, the protector of the Hebrews, three times in the constellation of Pisces. Such an event would not have been seen for many centuries.

In view of all this, it is tempting to conclude that Matthew was referring to actual events in his account of the star and the visitation of the magi. While this cannot be ruled out, the weight of the historical evidence seems to point against it. Moreover, if we take Matthew's story as an account of historical facts, we are saying, in effect, that God speaks to men through astrological signs. Modern studies have proven that astrology has no validity. Nevertheless, Matthew was living at a time when astrology was commonly practised. He may have become aware at some later date of an unusual celestial phenomenon at the time of Jesus' birth and of its astrological interpretation and may then have used it as a symbol for his own theological purposes.

We can never be quite sure just what the star of Bethlehem really was. But for us, as for Matthew, its true significance is symbolic. It stands as a celestial emblem of salvation, hope, and love, and continues to hold forth, Christmas by Christmas, the ideal of peace on earth, good will toward men.



CHRIS SASAKI, ROM

John Kenny received a four-year B.Sc. from the University of Toronto. During his undergraduate years he worked as a part-time projectionist at the Planetarium. In 1979 he was able to combine his two greatest interests—popular science and the theatre—when he joined the McLaughlin Planetarium as a full-time producer.

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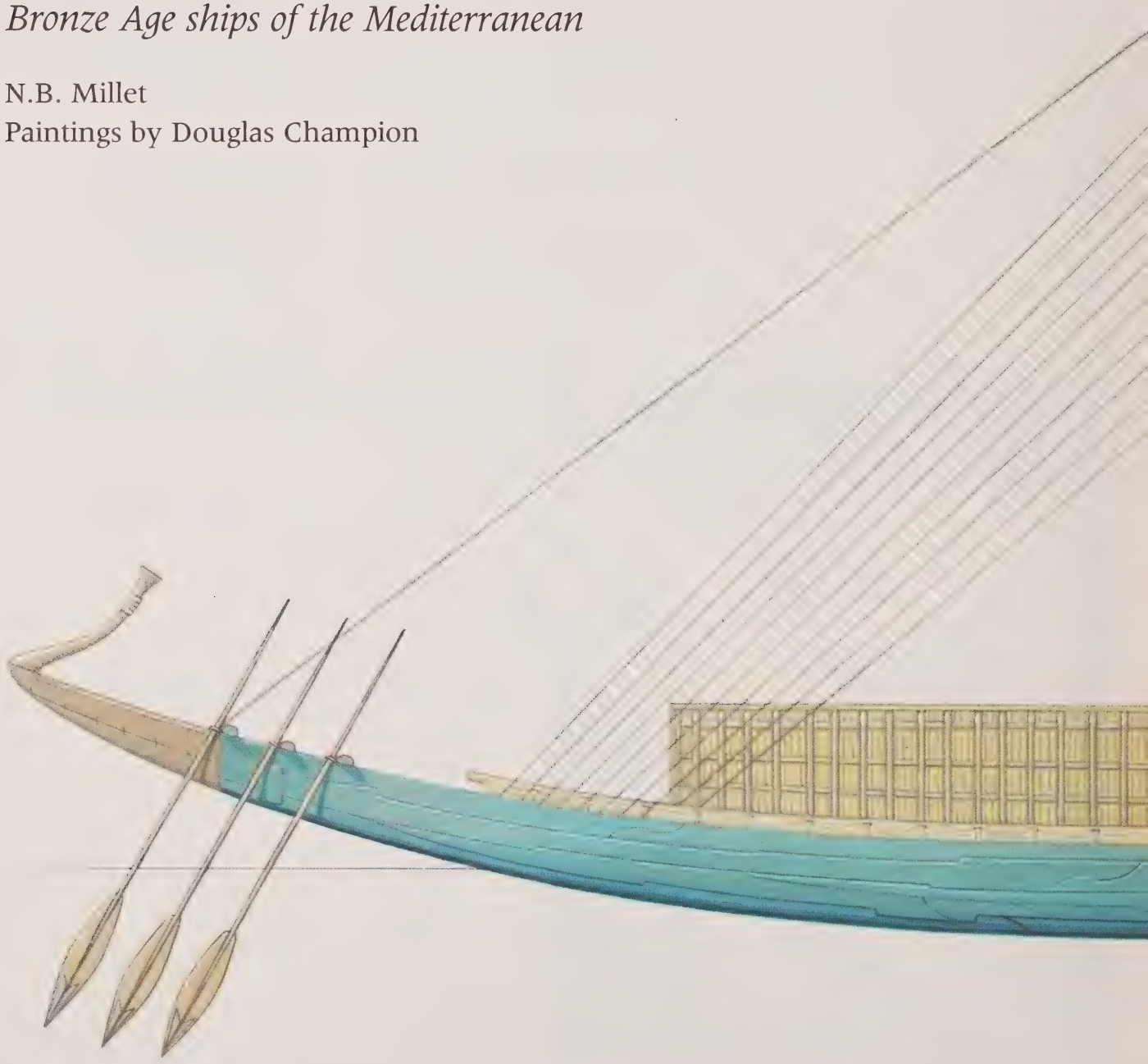
Before the Argo

Bronze Age ships of the Mediterranean

N.B. Millet
Paintings by Douglas Champion



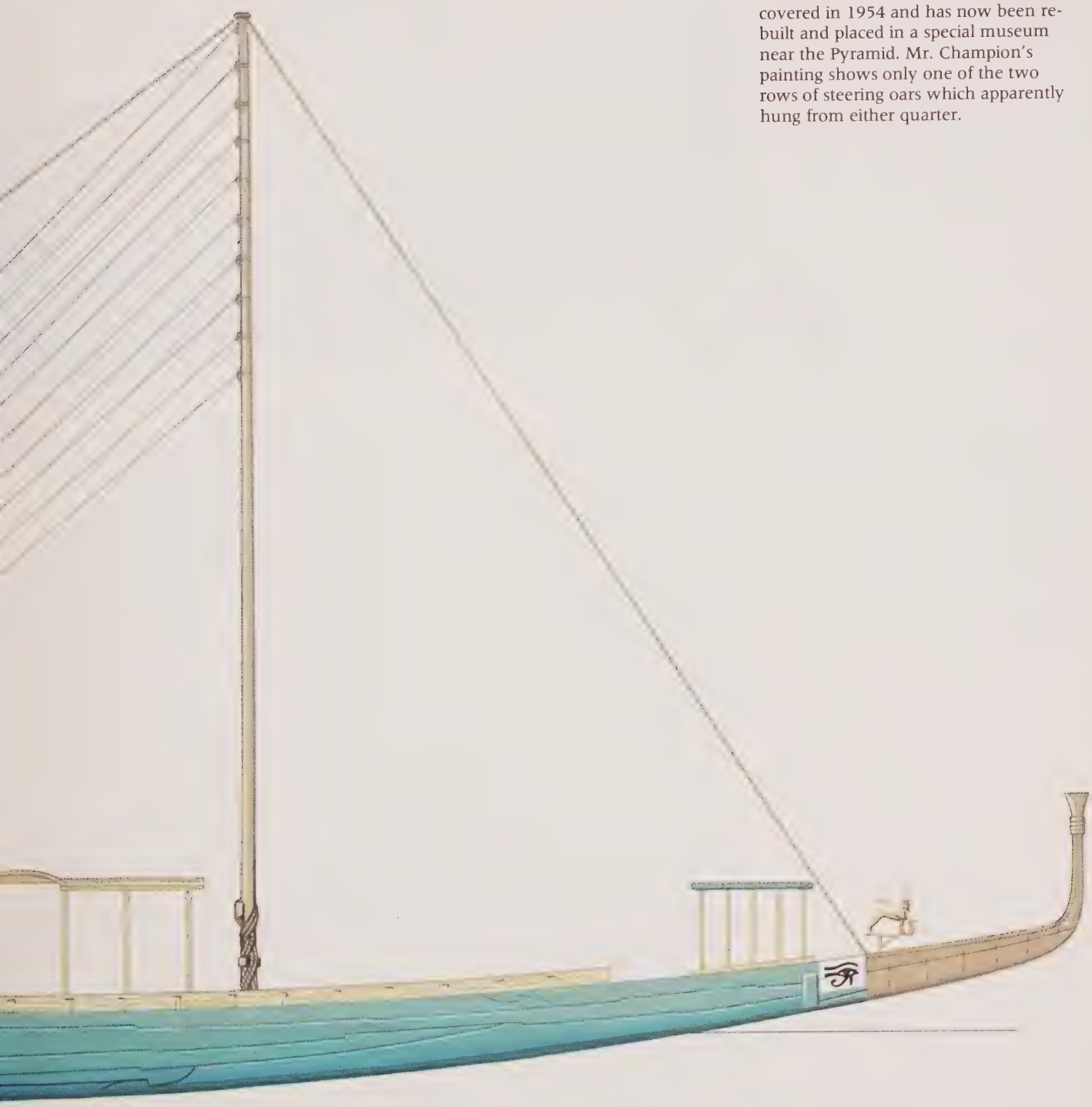


Fig 1: In this reconstruction by Toronto artist Douglas Champion, the royal barge of King Khufu, builder of the Great Pyramid, is shown as it would have appeared sailing on the Nile. Buried in a rock-hewn pit to accompany its owner to the next world, it was discovered in 1954 and has now been rebuilt and placed in a special museum near the Pyramid. Mr. Champion's painting shows only one of the two rows of steering oars which apparently hung from either quarter.

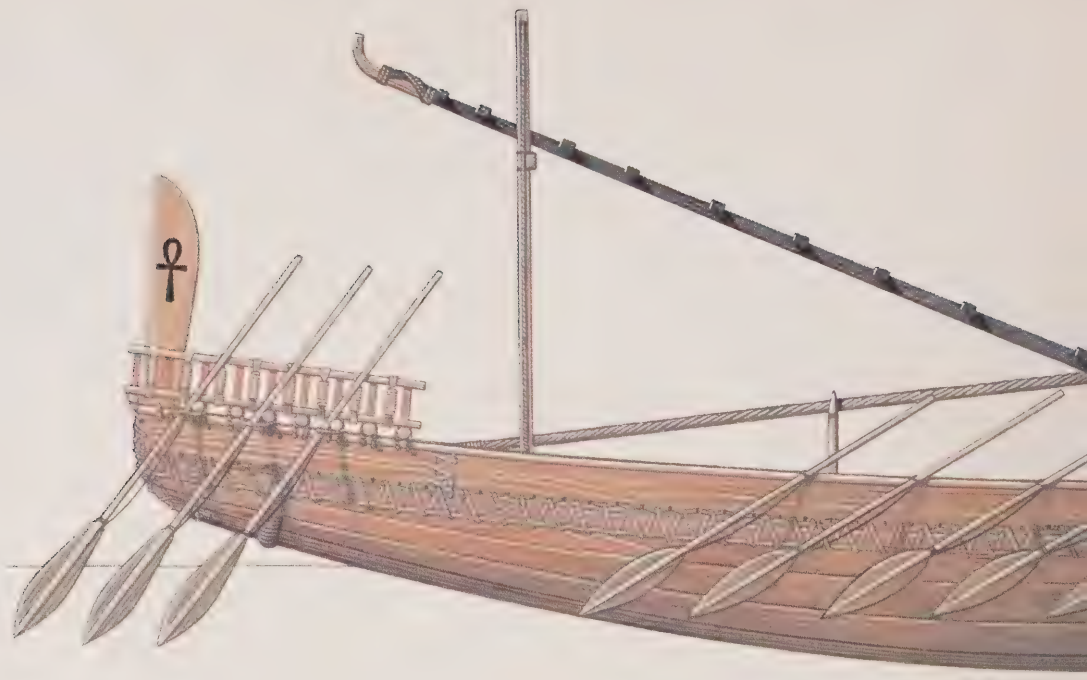


Fig. 2: With its towering bipod mast lowered into supporting "sheers", an Egyptian ancestor of the *Argo* moves under oars to its anchorage. Ten such ships are shown on a temple wall of King Sahure of the Fifth Dynasty, a monarch who was deeply interested in foreign trade. Such vessels were called "Byblos-ships" by their Egyptian crews, after the main Levantine port to which they sailed.

Sometime late in the 13th century before Christ, according to Greek legend, a band of heroes set sail from Iolcus in Greece in quest of the fabled Golden Fleece. Their journey took them across the Aegean Sea, through the length of the Black Sea to Colchis and finally home again. Whatever may have been the historical reality, if any, underlying the tale, the Greeks regarded the story with great respect and felt a great pride that their countrymen had managed such a long and hazardous journey at what they felt was the beginning of their history as a nation. As so often, the Greeks were giving less than due credit to their older neighbours in the eastern Mediterranean.

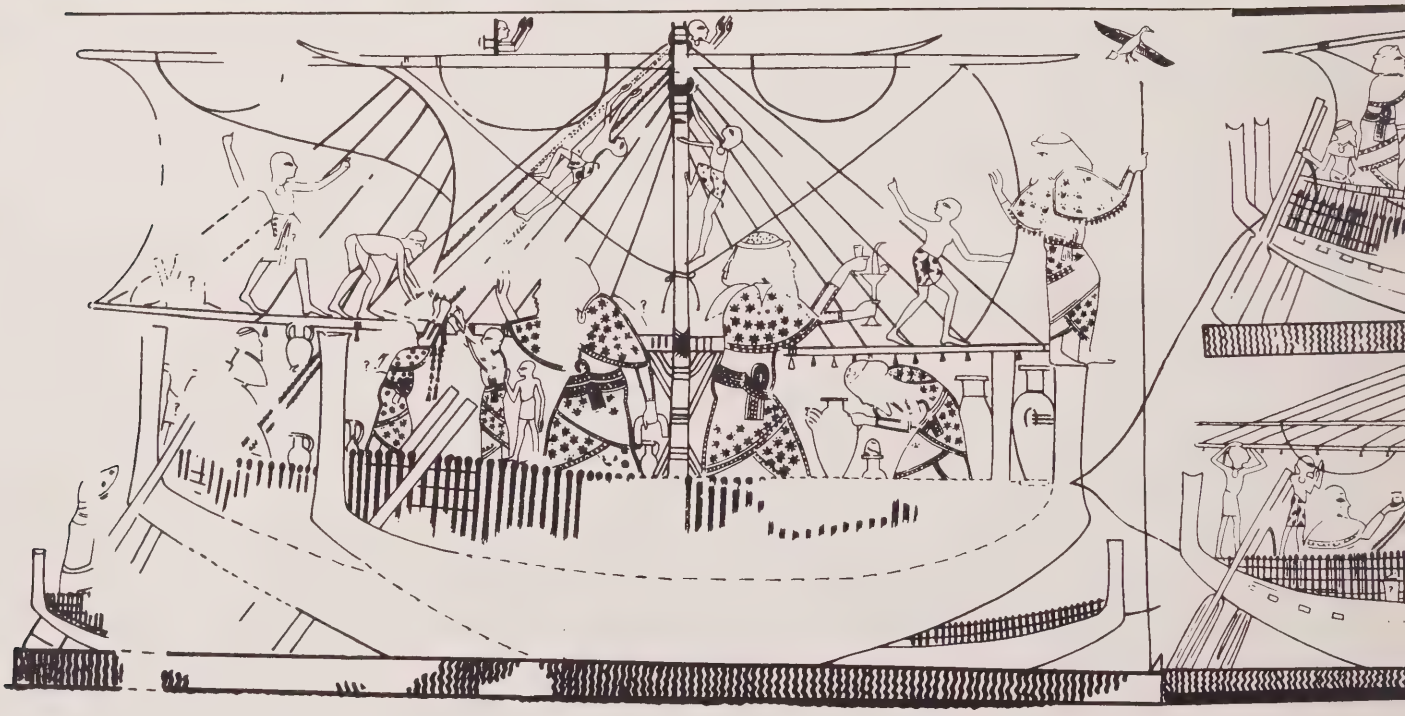
In the days of the Bronze Age, beginning early in the third millenium B.C., the eastern half of the Mediterranean Sea was already a bustling highway for the shipping of the many nations that lined its shores. Early seamen—with some trepidation, we may imagine—set forth from the mouths of the Egyptian Delta, from Byblos, Tyre, and Sidon on the Phoenician coast, from the harbours of Cyprus and the Anatolian shore, and from the innumerable coves and beaches of Crete and the Greek islands. The sailing season was necessarily a short one; only the summer months were really safe for navigation, since the Mediterranean is not always the smiling sunlit sea of the travel posters. During the stormy season—from October through April—the ships would be dragged up on the beaches or rafted together in the small harbours of the day, and their crews would seek other work. Even during the sailing season the Mediterranean is capable of sudden and dangerous squalls, and ancient shipmasters were a cautious breed, tending to hug the coast whenever possible and sailing along well-established routes that involved as little use of the open sea as was feasible. Added to the perils of the sea itself was the always present danger from the pirates who infested the coasts and islands, a menace that was not decisively dealt with until the days of the Roman Empire. Despite all these dangers, however, the seamen of the Bronze Age ventured forth year after year, their small, single-masted ships loaded with raw materials and manufactured goods alike, plying long-established trade routes that formed part of a web of land and sea commerce covering the entire ancient world.

About the ships themselves we know surprisingly little. A few crumbling wrecks of the period have been identified by underwater archaeologists; a small number of pictorial representations are known from Crete and elsewhere. Most of our evidence on early shipping, however, comes from the rich trove of illus-

trations on the walls of Egyptian temples and tombs, which provide us with a wealth of information about early ships in general. Most of these representations, to be sure, are of Egyptian river craft; the importance of the Nile waterway to Egypt's domestic economy had resulted in the creation of a large, active, and diverse river fleet for the movement of cargoes and passengers. But the dependence of Egypt on many imported staples encouraged the early development of seafaring as well, and it is in the carved and painted wall-pictures of Egyptian monuments that we find the first representations of seagoing vessels, both those of Egypt itself and those of foreign nations. The observant eye and lively curiosity of the Egyptian artist make these representations of great value as evidence; detail abounds, and significant variations from one type to another are more or less faithfully noted. A close examination of the evidence from Egypt, together with what little survives elsewhere, gives us a fairly clear picture of the development of ancient ships before the Iron Age.

The word "development" is used advisedly. During the course of more than three thousand years of pharaonic Egyptian history many technical improvements can clearly be seen, as contemporary reliefs and paintings reflect the ancient sailors' constant search for more efficient gear and better sailing qualities in their craft. No doubt many of these improvements were invented outside Egypt, for it is likely that useful ideas in a vital field like shipping would spread fairly rapidly from culture to culture, despite the well-known conservatism of sailors. But it is in Egyptian pictorial art that we first see such innovations as the fixed rudder or the loose-footed sail with brails. Thus to a certain extent the Egyptian evidence can be taken as a mirror of technological advance in the ancient maritime world as a whole; and it shows us a remarkable picture of ancient man at his practical best.

The most striking archaeological find of the 1950s was the discovery, in a long rock-cut pit just to the south side of the Great Pyramid, of a well-preserved wooden ship some 43 metres in length. The vessel had clearly belonged to the river fleet of King Khufu, the builder of the Pyramid, who reigned over Egypt about 2570 B.C., and it had been buried near him for his use in the afterlife. Near the pit in which it was found lies another similar sealed pit, and there can be no doubt that a second ship awaits discovery and study when the conservation problems posed by the first have been solved. This vessel has proved to be a royal state ship of a type known from contem-



porary pictures and apparently called a *dwa-towy*, meaning "that which the Two Lands (Upper and Lower Egypt) praise" (Fig. 1). Built almost entirely from cedar imported from the Lebanon, the vessel has a long, gracefully curved hull, with elaborate stem and stern posts rising high above the water and terminating in finials shaped like the heads of papyrus plants. The hull lacks a true keel, as did apparently all ancient ships until a much later date; it was built up by piecing the shell together and then inserting a framework, instead of assembling the framework first, as is modern-day practice in most parts of the world. The planks of the shell were pegged and lashed together without the use of metal nails. A cabin for the royal passenger and his following occupied much of the deck area, and several long steering oars had been provided. No mast or sailing gear were found with the remains of the boat, but a somewhat later representation of a *dwa-towy* shows such in place. The mast would have been the bipod mast usual on the Nile at the time and known from private tomb-pictures; it would have been provided with a high narrow sail spread on two yards; the upper one could be raised or lowered to set or take in the sail. When the wind was unfavourable the ship would probably have been driven by paddles rather than oars working in oarlocks; the more primitive method of propulsion would have been favoured, for traditional reasons, in the case of the royal yacht.

From this astonishingly well-preserved archaeological find Egyptologists and naval historians have learned most of what they know about ancient shipbuilding on the Nile. There can be no doubt, however, that Khufu's royal ship sailed only on the river; it was not intended for seafaring and would have been quite dangerously unsuitable for the open sea. It can be assumed, though, that a seagoing vessel of the period would have been built in essentially the same manner. Although no pictures of seagoing ships survive from Khufu's own time, we are fortunate in having a very detailed and explicit representation in a relief carved on a temple wall of about a hundred years later. The pharaoh Sahure, of the Fifth Dynasty, saw fit to commemorate in his funerary temple a trading fleet he had sent to the Phoenician ports; a reconstruction of one of the ships from the relief in Sahure's temple is shown in Mr. Champion's painting on pages 20–21 (Fig. 2).

Much about Sahure's craft is similar to Nile ships of the same period

Fig. 3 (opposite page, top): In his tomb at Giza, the treasury official Kaiemankh is shown sailing on the Nile on government business. His ship is a typical Nile passenger and cargo vessel of the period, with bipod mast, tall narrow sail, and multiple steering oars in two sets, one to port and one to starboard.

Fig. 4 (below): Phoenician traders come ashore at Thebes in the reign of Amenhotep III. Reporoduced from the *Journal of Egyptian Archaeology* 33 (1947) pl. VIII, by kind permission of the Committee of the Egypt Exploration Society.

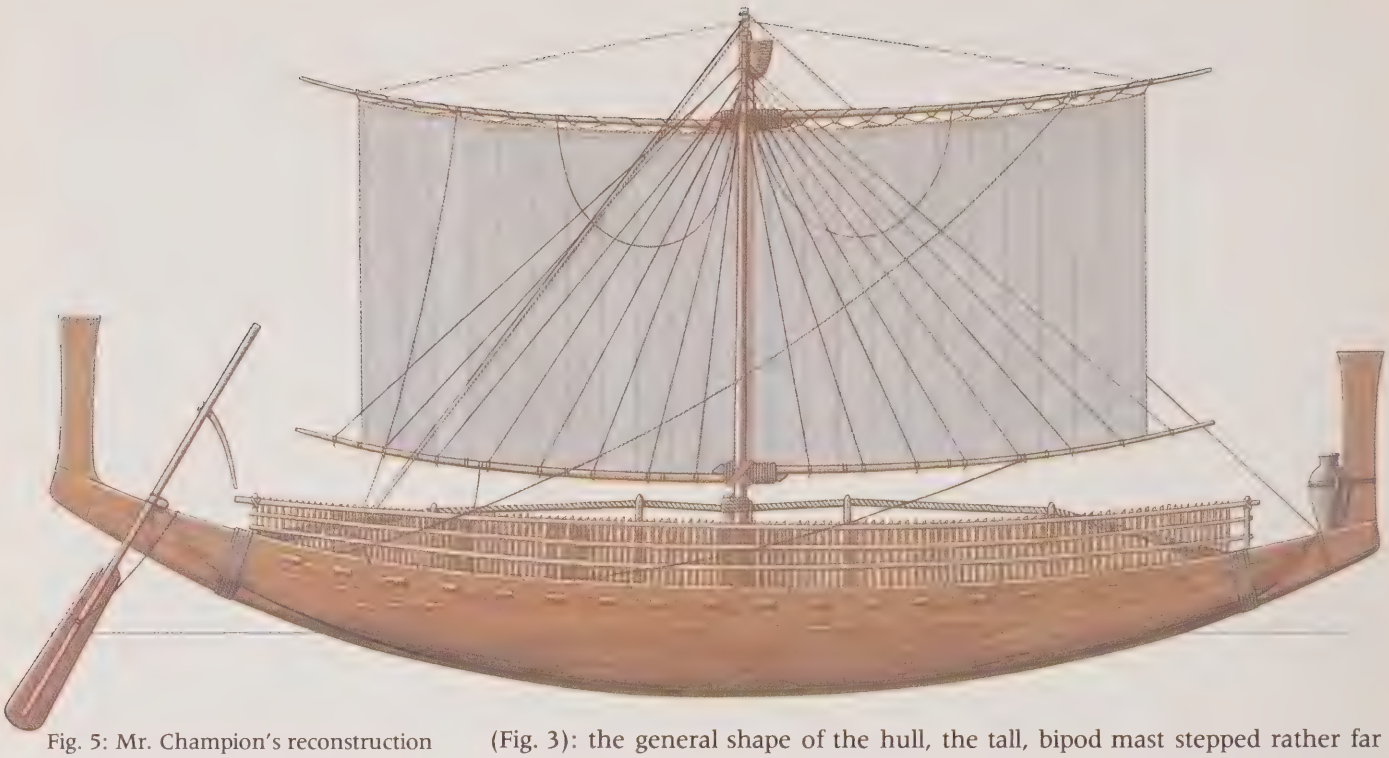


Fig. 5: Mr. Champion's reconstruction of a Phoenician trading vessel of about 1400 B.C. shows one of the two free-swinging steering oars that seem to have been standard steering gear for seagoing ships of the Bronze Age. The rig does not differ from that of Nile ships of the same period. In the bows of the ship a large amphora probably contained oil to be poured on the water ahead of the ship in heavy seas.

(Fig. 3): the general shape of the hull, the tall, bipod mast stepped rather far forward, and the cumbersome series of long steering oars at the stern. There are differences as well, however; the strangely shaped vertical bow- and stern-posts are not found on Egyptian riverboats of normal type, and strangest of all, each of Sahure's ships is provided with an enormous hawser of twisted ropes running the length of the vessel from bow to stern and raised above the deck by massive forked stanchions. This is clearly what is now known as a "hogging truss", a tension cable used to increase the strength of the hull by bracing its two ends together. Each truss is shown with a sturdy baulk of wood thrust through its strands—what sailors used to call a "Spanish windlass"—by which it can be tightened when the rope stretches. Clearly this device would have compensated a great deal for the absence of a true keel and of a continuous deck, the two elements that provide longitudinal strength to wooden vessels nowadays. The vertical posts at stem and stern, and the bindings shown in the relief, strongly suggest that the ships of Sahure were sharp-ended, unlike Nile craft of the same period.

From contemporary inscriptions we learn that this type of ship was called a *kbnt* in Egyptian, that is, a "ship of Kubna". Kubna or Kubla was the ancient name of the Phoenician port of Byblos, and the designation "Byblos-ship", beginning as a term indicating the destination of such vessels—like the older English seafarer's "Indiaman" or "China clipper"—quickly became the regular Egyptian word for a seagoing ship in general. Much later, at the time of the Persian Wars, it was used for triremes and other war galleys of the classical type.

Sahure's picture would strongly suggest that his ships, with their characteristic bipod masts and the hieroglyphs painted on bow and stern, were Egyptian-built, and the crews with their short haircuts, beardless faces, and typical Nile sailors' loincloths, were clearly Egyptian. The oddity of the distinctly un-Egyptian bow and stern timbers, however, does remain to be explained, and the question arises as to whether the vessels in the relief were a type developed by Egyptian shipbuilders for sea voyages or whether they were imitations of a foreign prototype evolved by a nation more at home on the open sea, such as the Phoenicians themselves.

The problem is that the early Phoenicians have left us no pictures of their own vessels with which to compare these early Egyptian seagoing craft; not until a thousand years later, and then only in another Egyptian wall-scene, do

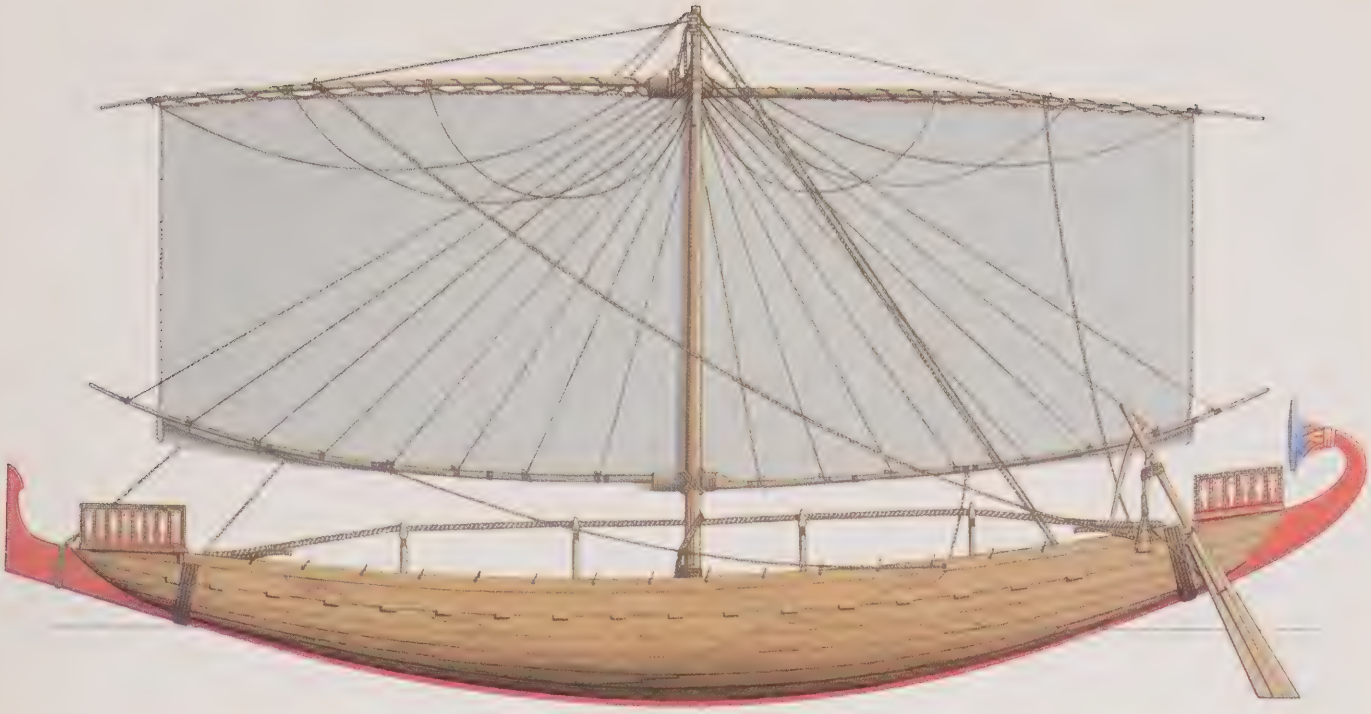


Fig. 6: The "Byblos-ship" of Queen Hatshepsut (ca. 1500 B.C.) differs from those of Sahure in the proportions of the sail, details of hull decoration, and the more sophisticated steering gear. Such vessels could only sail before the wind, and had to rely on oars when the wind was contrary or weak. Their voyage to Punt and home again may have taken the better part of a year.

we see what kind of ship was in use by the sailors of the Levantine coast. In the reign of the great pharaoh Amenhotep III, the grandfather of Tutankhamun, a mayor of Thebes named Kenamun had one wall of his tomb decorated with a painting of Phoenician ships landing at an Egyptian harbour, perhaps that of Thebes itself. The painting is now unfortunately destroyed, but a drawing of it made in 1922 by N. de G. Davies tells us a great deal (Fig. 4).

The ships are shown approaching the quay and then drawn up to it; several members of the crews, their nationality proclaimed by their long multicoloured robes and their beards, have already disembarked and are chaffering with the proprietors of waterside shops. The ships themselves show clearly the high vertical stems and stern-posts of the Sahure ships, albeit of a different silhouette, and a hoarding of lattice-work or some similar light material runs along each bulwark, probably to increase the freeboard and make the vessels more seaworthy. No hogging trusses are visible, but the hoardings may conceal them, and their presence in Egyptian seagoing ships of the period (Fig. 7) suggests that they would still have been in use in craft built without a keel. All in all, one can hardly avoid the conclusion that the sharp-ended ships of Sahure resemble these Late Bronze Age Phoenician traders more than they do the traditional blunt-ended riverboats of Egypt. Perhaps, then, it was indeed the early Phoenicians who first developed truly seaworthy ships, which were then used by the early Egyptians as models for their own developing deep-sea fleet.

Always traditionally minded, the Egyptians seem to have felt that the bow and stern ornaments that we see on the Sahure ships were proper decoration for all seagoing craft, for something like them appears again, a little before Kenamun's time, on the ships of the famous Red Sea fleet of Queen Hatshepsut, depicted on the walls of her funerary temple at Deir el-Bahri, opposite modern Luxor. The queen had, it seems, conceived the notion of a trading venture to the land of Punt—probably on the north coast of Somaliland, although other locations have been suggested. It was no inconsiderable journey, being about twice as far as Colchis was for the fabled *Argo*. In her inscriptions the queen assures us that "the like had never been done before since the time of the Ancestors", although we know very well, as did her subjects, that such voyages had been undertaken regularly for at least a thousand years. Still, politics is politics; we should not blame the queen too much for bragging about her feat, and still less for covering so many square metres of her temple wall with a marvel-

ALAN HOLLETT, ROM

Fig. 7: A 13th-century seagoing ship appears in a carved hieroglyph approximately 15 cm long, from a victory inscription of the Pharoah Ramesses II at his temple at Abydos. Such details as the steering gear and the "hogging truss" are clearly shown.

lously detailed and explicit representation of the fleet's arrival and departure from the legendary incense-producing land of Punt.

The ships themselves—there seem to have been five of them—were probably fairly large vessels, their hulls built in much the same fashion as the ship of Khufu, that is, as shells of heavy planks pinned and lashed together, with the frames set in afterward. Comparison with ancient models of Nile ships, some of them from the tomb of Tutankhamun, show that by the queen's time (ca. 1500 B.C.) the hull shape of the Egyptian ship was now sometimes extended fore and aft by overhanging trunklike elements (Fig. 6). Whatever the actual purpose of these projections, on the Punt ships of the queen the forwardmost culminates in a vertical timber shaped like the stems of the Sahure ships, while the sternmost is now Egyptianized by a great forward-curving papyrus-head finial. Conspicuous also is the great hogging truss with its series of stanchions.

The rig of the queen's ships is exactly the same as that shown in innumerable tomb paintings of Nile ships of the period, and consists of a single rather than a bipod mast, carrying a wide sail spread on two yards, the lower of which is lashed firmly to the mast, while the upper yard can be hauled up and down the mast to set and lower sail. The actual details of the rig are clearly shown in the queen's relief; most striking is a number of ropes spreading downwards from the head of the mast to the lower yard. The purpose of these lines is uncertain, since they are far more in number than would have been needed to support the arms of the yard, but they figure in ancient representations of Nile craft from the time that this new wide, low sail displaced the high narrow one of the Sahure ships, sometime around 2200 B.C. The Phoenician traders show exactly the same distinctive rig, and it is significant that the recently discovered Minoan frescoes at Thera depict ships of an exotic hull shape but with precisely the same mast, sail, and rigging. It is obvious that we are dealing here with a basic type of rig which was widespread, if not indeed universal, in the eastern Mediterranean during the latter part of the Bronze Age.

Hatshepsut's ships are each steered by a pair of great wooden oars, fixed to the sides of the stern and with their upper ends lashed into the forked tops of solid posts. A long, slightly curved tiller through the shaft of each oar enables the helmsman to rotate the wide blade with ease. This very sophisticated device, evolved from the much less efficient multiple steering oars of Khufu's and Sahure's day, is essentially the equivalent of the fixed rudder. It has already

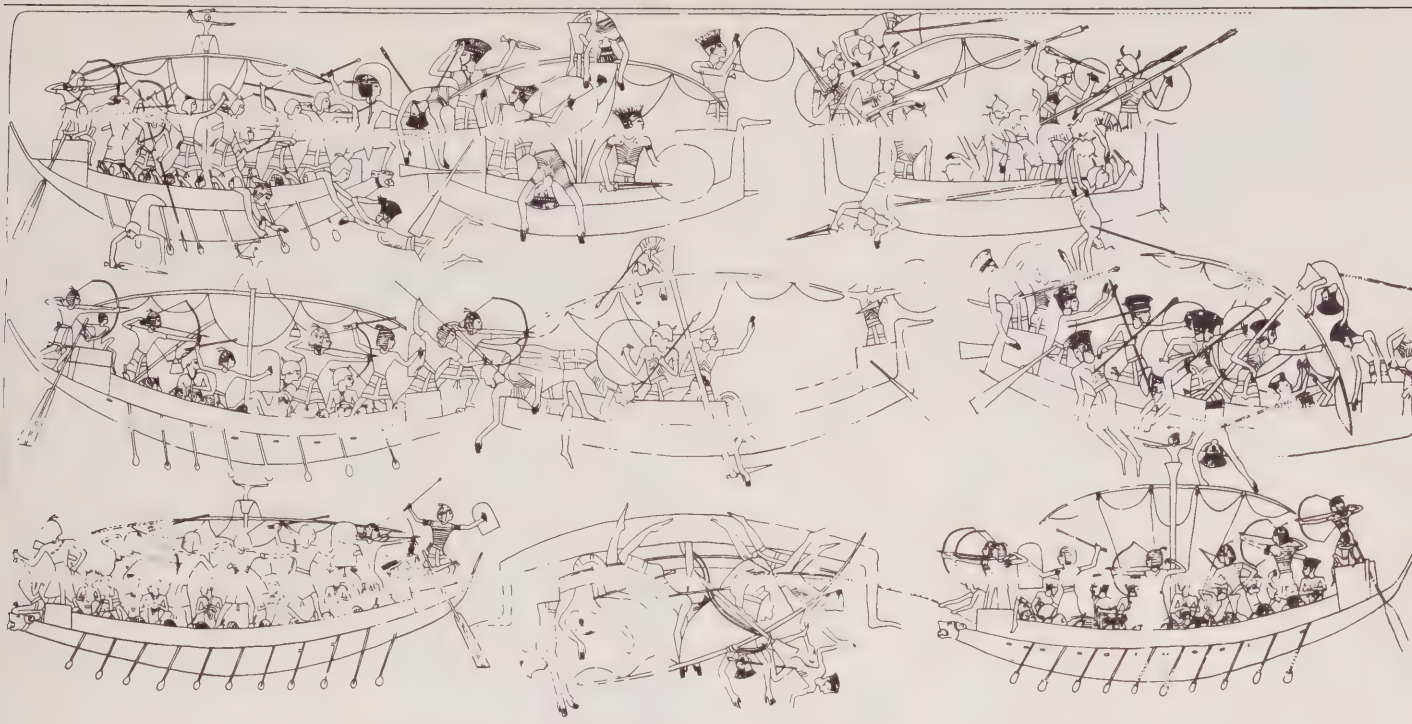


Fig. 8: The Egyptian war fleet under King Ramesses III traps the invading armada of the "Peoples of the Sea" at the mouths of the Nile, wreaking slaughter among them. In the enemy ships can be distinguished two different national groups, one wearing tall flaring helmets—probably Philistines—and the other in round horned headgear. The innovative new loose-footed sail appears on the ships of both fleets. Reprinted from the *Journal of Near Eastern Studies*, Vol. II, No. 1, Jan. 1943, George G. Cameron, ed., by permission of The University of Chicago Press.

made its appearance in the late Old Kingdom, developing from the simple steering oar through a form with a short tiller that permits the helmsman to rotate the blade and so to avoid the necessity of swinging the oar to port or starboard. Many Nile craft of Hatshepsut's time have a single such oar fixed amidships over the stern, and only a purist would deny that this is essentially a rudder.

From the Kenamun painting (Fig. 4), however, we can see that although the Phoenician traders are each equipped with two tillered steering oars identical to those of the Punt ships, the oars are not mounted on stanchions but seem to swing free from their point of attachment at the gunwale. This might be put down to carelessness on the part of Kenamun's artist if it were not for corroborating evidence from the time of Ramesses II of the Nineteenth Dynasty (1298–1233 B.C.). In a large-scale hieroglyph on the wall of a temple at Abydos, an Egyptian seagoing ship of the period is clearly depicted (Fig. 7). It exhibits a high bow and stern very similar to those of the Kenamun ships, the same lattice-work hoardings along the gunwales, the hogging truss, and two steering oars without stanchions, one of them canted upward in a way that would not have been possible had it been lashed firmly in place. It would seem that this Egyptian vessel of the king's Mediterranean fleet was built in the Phoenician and Syrian tradition, and that the sea-wise sailors of the Levantine coast preferred a loosely mounted steering oar, which would be less rigid and thus less likely to snap in a heavy sea. When Thor Heyerdahl made his celebrated crossing of the Atlantic in an Egyptian-style papyrus ship, the pair of steering oars, ridigly mounted in imitation of the ships of Hatshepsut, gave constant trouble and required frequent repair, as he tells us in his narrative of the voyage (*The Ra Expeditions*, London, 1971).

Why Hatshepsut's Red Sea ships retained the traditional steering arrangements of the Nile is a puzzle, but it may be that the stanchions that we see supporting the steering oars were simply dismantled when wave action became any kind of a problem; the elaborate lashings, with rods for tightening them, have the look of something intended to be loosed when necessary. In any case, the loosely mounted steering oar became the standard steering device in Mediterranean ships until late in the Iron Age, when it seems to have been moved farther forward on the ship's side, where it was better protected against the pounding of the waves.

It is a pity that the artist who carved the Abydos hieroglyph did not see fit to

Fig. 9: An Egyptian war galley of the time of the legendary *Argo*. A single loosely hung steering oar controlled the ship's course. Brails running through metal rings on the sail made possible the management of the sail by a small crew, an improvement of great importance to merchantmen as well.

show the ship complete with mast and sail, but it can be reasonably conjectured that the rig was the same as that of Hatshepsut's Red Sea galleys. The first sign of any change in this area of maritime technology comes suddenly at the beginning of the 12th century B.C.—just about the traditional date of the *Argo*'s voyage—and again it is the Egyptians who provide us with the evidence.

The opening years of the 12th century B.C. were a time of tumult and the fall of empires. Waves of migrating or expansion-seeking peoples from western Asia Minor and the Aegean islands moved eastward by land and sea, leaving destruction in their wake. The empire of the Hittites and the sea-kingdoms of Cyprus and Ugarit were swallowed up in a series of cataclysms that left only Egypt to stand against the "Peoples of the Sea", as they were called by their Egyptian enemies. The legend of the fall of Troy had its origin in these conflicts; so, probably, did that of the *Argo*, whatever we are to make of the tale itself. It was in fact the bloody birth of the period which we call the Iron Age, and it would seem that only Egypt survived the event as mistress of her own destiny. The reigning pharaoh, Ramesses III, turned back the invaders in a series of battles, at least one of which was a sea battle. On the walls of his funerary temple at Medinet Habu, only two kilometres from Hatshepsut's own temple, he had a large-scale representation of the battle carved; ships of the Egyptian fleet grapple with those of the invaders in an anchorage (Fig. 8). It is notable that all the ships shown in the battle seem again to have steering oars slung loosely, without the supporting stanchion. The Egyptian ships seem to have only one oar, while those of the Peoples of the Sea have two of a somewhat different shape, shown canted at different angles. The relief itself was once richly painted, like all Egyptian carvings, but the passage of three thousand years has removed all trace of colour and with it, no doubt, much added detail that was not carved in the stone. It is uncertain, for instance, whether the hoarding along the bulwark, which here presumably serves to screen and protect the

A wall chart containing full-colour reproductions of twelve superb paintings of ancient Egyptian ships by Mr. Douglas Champion, with explanatory text by Dr. N.B. Millet in English, French, and German, will shortly be available from ROM Publication Services. Approximate dimensions: 122 cm × 81.4 cm (48″ × 32″). Price: $7.50. The full-colour wall chart by Mr. Champion and Dr. Millet of Egyptian hieroglyphs (118 cm × 78.7 cm), also with text in the same three languages, is still available. Price: $4.95 (in mailing tube).

rowers from enemy missiles, is to be taken to be of lattice-work, wood, or heavy canvas. No decoration is preserved, of course, on the hulls or upperworks of the Egyptian galleys, but Douglas Champion has reconstructed such in his painting (Fig. 9), since it is unlikely that the king's war galleys would be less richly ornamented than his river fleet. The warships of the Peoples of the Sea are reminiscent of the Phoenician traders shown in Fig. 4, save that their stems and stern-posts, instead of flaring outwards at the top, are carved to resemble the heads of long-billed birds; bow- and stern-castles are also shown, probably to protect the fighters.

While the general hull shape of the ships of both Egyptians and invaders is reasonably familiar-looking, the rig shown on both is new and distinctive. All the ships are shown with their sails stowed, but instead of the upper yards being lowered in their slings, as in earlier depictions, they are shown here still hoisted to the mast-heads, with the sails furled up to them by a system of "brails". These are the lines visible as running from the foot of the mast to the yard; from later, more detailed representations, and from written description, we know they would have been attached to the foot of the sail, run up the sail through metal rings sewn to the canvas, through fairleads at the yard, and thence down to the deck (see Mr. Champion's reconstruction). A small crew could thus furl the sail by hauling on these lines from the deck, and set the sail again simply by casting them off and hauling the sheets home. There is clearly no longer any lower yard, the sail being spread at the foot only by the sheets made fast to the lower corners. This, then, is the first appearance of the classical loose-footed sail, with its greater manoeuvrability and ease and convenience of use, which became the basic pattern for all square sails until the advent of steam. Sails of this type were used at Salamis, at Lepanto, and still at Trafalgar, and it may well be that the legend of the far-sailing *Argo* somehow enshrines a memory of this epoch-making invention by some nameless seaman of the Late Bronze Age.

BRIAN BOYLE, ROM

N.B. Millet grew up in the Far East, where as a child he was fascinated by the junks and sampans of China's teeming anchorages. Coming to the ROM's Egyptian Department in 1970 as associate curator, he is now curator and also professor in the University of Toronto's Department of Near Eastern Studies, where he teaches Egyptian art and archaeology. Dr. Millet is an armchair sailor of many years' standing; his present armchair is a 22-inch mahogany and foam-rubber model of traditional design, rigged for single-handed sailing, but he feels he is outgrowing it, and hopes soon to acquire something "a bit more roomy and challenging".

BILL ROBERTSON, ROM

After the closing of the exhibition *The Arts of Italy* at the Art Gallery of Ontario, the ROM's European Department received as a gift from one of the lenders to that show a gilt bronze plaque (17.2 cm × 11.4 cm) depicting the entombment of Christ. The plaque is notable for the expressiveness of each of the nineteen faces in the scene and has been traditionally attributed to Andrea Briosco, called Riccio, a 15th-century Paduan sculptor, generally considered to have been the strongest exponent in the field of bronze sculpture at the time.

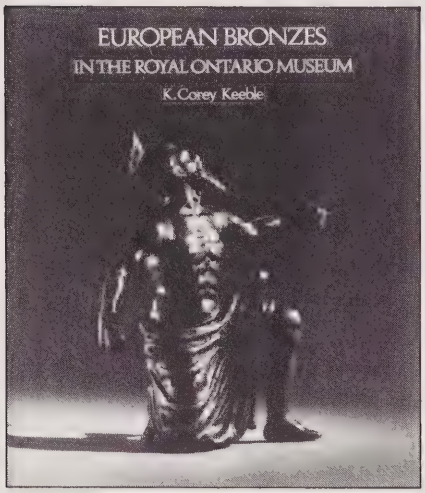
This fine object was acquired by our donor in 1940 on the New York art market. It came from the collection of Raphael Stora, a notable collector, who had bought it from Baron Erich von Goldschmidt-Rothschild. The plaque has been exhibited on a long-term loan at the Montreal Museum of Fine Arts and will now find a permanent place of honour in the ROM's new display.

Another gift, also of early date, from the same generous sponsor shows perfection of craftsmanship in a small gilt metal object. It is a silver wine cup with parcel gilt, ornamental, and other repoussé decorations. Four angels' heads on wings are set in reserves of elaborate Renaissance scrolls and fruit arrangements, while the slender baluster stem rests on a fluted foot with raised scroll decoration. No marks can be found, but the craftsmanship suggests a German or Dutch master of the mid-16th century.

The European Department is deeply indebted to its generous benefactor. In recent years it has rarely been possible to acquire first-quality material of early periods, so that until now the department's collection of sculpture in metal has consisted largely of examples dating from the mid-16th to the 19th century.

H.H.-S.

Be careful! That's Chivas Regal!

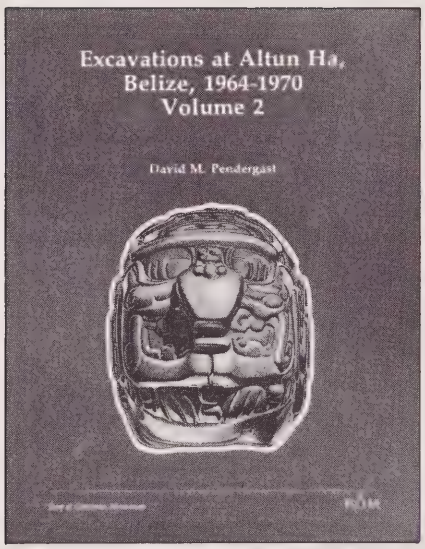


European Bronzes in the Royal Ontario Museum, ROM, K. Corey Keeble, 256 pp., ill. b&w and colour, $45.00 cloth

During the last two decades the bronze sculpture collection in the Royal Ontario Museum has been developed into one of major importance. Superbly illustrated with more than 200 photographs, this catalogue presents an overall view of the Museum's works in bronze, brass, and copper from the Late Roman period, through the Middle Ages, the Renaissance, the Baroque, the Neoclassical, and the Romantic periods. In all, 107 objects are described, with the emphasis on the Renaissance and the Baroque statuette.

The Royal Ontario Museum's Statement of Principles and Policies on Ethics and Conduct, prepared by the Committee on Ethics and Conduct, 103 pp., $15.00 paper

This publication represents the comprehensive statement of ethics and conduct for the Royal Ontario Museum approved by the ROM Board of Trustees in February 1982. The document addresses itself to ethical questions involving the institution, the collections, and the staff. The chapter on museum governance deals with the ethical responsibilities of the Board of Trustees, the Director, and Management. There is also a section on Volunteer ethics, as well as a glossary and a bibliography. This publication will be of interest to the museum community, both national and international.



Excavations at Altun Ha, Belize, 1964–1970, Volume 2, Archaeology Monograph, David M. Pendergast, 320 pp., illustrated book (paper) with 44 unbound architectural drawings, in box, $45.00

The first volume of this five-volume series was called "a significant contribution to our understanding of public life in Maya civilization" by David A. Freidel in *Science*, and "an architectural tour de force" by Payson Sheets in *American Antiquity*. Continuing this comprehensive study, Volume 2 encompasses Group B, the southern portion of the central ceremonial precinct, and Zone C, the first of several outlying zones to be examined. Details of excavation, construction history, burials and caches, dating, and post-abandonment activity, make this book an important archaeological work. Volume 1 is available at $30.00.

Redescription of Type Specimens of Species of the Bryozoan Genera, *Dekayia, Homotrypa*, and *Stigmatella* from Upper Ordovician Rocks Along Workman's Creek, Ontario, ROM Life Sciences Contribution 132, Madeleine A. Fritz, 34 pp., illustrated, $3.00 paper.

Tertiary Mammals of Saskatchewan Part VI: The Oligocene Rhinoceroses, ROM Life Sciences Contribution 133, Loris S. Russell, 58 pp., illustrated, $4.75 paper.

Upper Cambrian and Lower Ordovician Trilobite Biostratigraphy of the Rabbitkettle Formation, Western District of Mackenzie, ROM Life Sciences Contribution 134, Rolf Ludvigsen, 188 pp., illustrated, $11.50 paper.

Bronze Sculpture in Miniature

Baroque medals of Massimiliano Soldani-Benzi

K. Corey Keeble

EBERHARD OTTO

Left: Soldani was master of another of the art forms revived during the Italian Renaissance—the small bronze statuette. This one, attributed to Soldani, *The Education of Cupid,* is hollow-cast bronze (H. 32.5 cm). It, like all the medals illustrated in this article, comes from the Margaret and Ian Ross Collection, on loan from the Ontario Heritage Foundation to the ROM.

Among the art forms of antiquity revived during the Italian Renaissance was that of the portrait medal. The greatest pioneer of its Renaissance development was Antonio di Puccio Pisano (ca. 1395–1455), better known to posterity as Pisanello, whose earliest medals were made in the late 1430s. They were masterly examples of small-scale portraiture and relief sculpture and were avidly collected by Renaissance connoisseurs as masterpieces in miniature.

Pisanello's activities as a medallist provide a focus for the study of the 15th-century development of the medallist's art. Local schools of medallists grew up in many of the areas to which Pisanello had introduced the new possibilities of this ancient and honoured art form. Surprisingly, Florence, in spite of its later reputation as the cradle of the Renaissance, seemed slower than other parts of Italy to take up and foster the development of the medal. Bertoldo di Giovanni (ca. 1420–1491), pupil of Donatello and for a short time teacher of Michelangelo—and, significantly, the first Florentine sculptor whose entire *oeuvre* consisted of small-scale bronze sculpture—was also one of the first to turn his attention to the design of medals in addition to statuettes and plaquettes. He produced memorable portrait medals of Sultan Mohammed II of Turkey, Emperor Frederick III, and, inevitably, medals commemorating the Medici, such as those of Lorenzo il Magnifico and Giuliano de'Medici.

Of more lasting importance to the history of the Florentine medal, however,

EBERHARD OTTO

Above and opposite page: Three medals of Queen Christina of Sweden (Diam. 6 cm).

was Niccolò di Forzore Spinelli (1430–1514), whose success in recording the features of his contemporaries was surpassed only by Pisanello himself. His work and that of his successors and followers prepared a path for the further advance of the Florentine medal, and, as portraiture, constitutes a useful gallery of Italian luminaries of the late 15th and early 16th centuries.

The medals of Spinelli and his successors represent an important extension of the tradition of Florentine bronze sculpture, which began with Ghiberti and Donatello in the early 15th century, was continued by Verrocchio and Bertoldo, and was carried on to new glory in the 16th century by Giovanni Bologna and his workshop in the Borgo Pinti. As it turned out, the art of the Florentine medal, as well as all affiliated forms of sculpture in bronze that had flourished during the Renaissance, was to undergo a period of regeneration and revival in the late 17th century under one of the most brilliant of all Florentine baroque sculptors, Massimiliano Soldani-Benzi (1656–1740). Soldani was a master of all forms of bronze sculpture, from monumental tomb sculpture to bronze reliefs, statuettes, and medals. In his art and in that of such contemporaries as Giovanni Battista Foggini (1652–1725), the centuries-old traditions of Florentine bronze sculpture experienced a last brilliant revival during the twilight years of Medici rule.

Soldani was of noble origin. From an early age he appears to have been drawn to the art of sculpture, modelling little figures and reliefs of clay to be fired at a local pottery. At the age of nineteen he was sent from his home at Montevarchi to Florence to study with the painter Baldassare Franceschini (1611–1689), who was instrumental in finding him a place in the drawing school run by Giuseppe Arrighi (active 1650–1680) in the Grand Ducal gallery. Soldani's ability soon attracted the attention of the court, and Grand Duke Cosimo III himself, after seeing examples of Soldani's drawings and his terracotta sculptures, instructed him to begin designing portrait medals. It was the beginning of a new era in the history of the Florentine medal.

To further Soldani's training in this art, the Grand Duke sent him to Rome in 1678 to study at the Tuscan Academy, where he stayed for four years. He studied drawing with Ciro Ferri (1634–1689) and sculpture with Ercole Ferrata (1610–1686), an associate of two of the most illustrious baroque sculptors in Rome, Bernini and Alessandro Algardi. In addition to tutelage from these two gifted masters at the Tuscan Academy, Soldani was instructed in the art of die-cutting by Giovanni Pietro Travani (active late 1600s). But it was in the design of cast rather than struck medals that Soldani excelled, and it has been remarked by the art historian Klaus Lankheit that it was the medal that was the cornerstone of Soldani's work as a sculptor. His medals, Lankheit has observed, are small-scale reliefs; his reliefs large-scale medals.

While in Rome, Soldani was introduced to a galaxy of the most famous and influential residents of the city by whom he was commissioned to design portrait medals. The most colourful of these was Queen Christina of Sweden, who had astonished her subjects by her refusal to marry, her abdication from the Swedish throne, and her conversion to Roman Catholicism. Her years in exile in Rome were distinguished by her enlightened patronage of the arts. In 1679 she decided to commission a set of medals—120 in all by some accounts—as a history of her life. This grand project was directly inspired by a similar one launched by Louis XIV of France in 1662—his *histoire metallique*—and was intended to rival and even to surpass it. Some of the symbols Christina wanted incorporated into her series were analogous to symbols used by France's "Sun King", with the addition of mottoes that provided satirical comment on his royal pride.

Christina approached Bernini with her plan, but he declined the invitation to design medals for her, citing his advanced age as the reason for his refusal. His real reason, however, seems to have been his anxiety over involvement with a patron who was notoriously demanding and impatient in her treatment of artists. It was Soldani who was then sought out to design medals for the series. In February 1681 he was approached by an emissary from Christina, and he accepted the commission. Soldani's designs began with a heroic idealized por-

trait of the queen, showing her crowned with laurel. For this obverse, he designed four reverses of allegorical subjects, each bearing the initials "G.D." as an abbreviation of the phrase GLORIA DEO or GRATIA DEO. These so pleased his patron that he was asked to produce further designs. From the first stylized portrait, Soldani advanced to a much more naturalistic and less official-looking form of portrait, showing Christina with her elaborately curled hair ornamented with ropes of pearls and her shoulders covered in a chemise and ermine-trimmed mantle arranged in a manner suggestive of classical draperies. As reverses for this more naturalistic obverse, Soldani used the same symbols and mottoes as for the first portrait.

The history of the Christina medals is complicated by the involvement of other artists in their design and execution. Both cast and struck specimens exist. Dies for the struck medals were cut by the engraver Giovanni Battista Guglielmada (active 1665–1688), and these later passed into the possession of Giovanni Hamerani (1649–1705), Master of the Papal Mint in Rome. Reverses of the struck medals show Guglielmada's variations on similar Soldani designs. Typical of the struck medals is an example from the Collection of Margaret and Ian Ross, on loan to the Royal Ontario Museum from the Ontario Heritage Foundation. The obverse shows the sharp contours typical of struck medals; though probably from a die cut by Guglielmada, it conforms to Soldani's first, stylized portrait of the queen. It is a rather formidable portrait, cool and aloof. The reverse shows a rayed sun with the motto NEC FALSO NEC ALIENO ("neither false nor borrowed"). The use of the sun motif clearly challenges Louis XIV's adoption of a similar device, and the motto appears as a critical comment on Louis's own motto NEC PLURIBUS IMPAR ("sufficient for many worlds"). Christina's motto has been interpreted as suggesting that, unlike Louis's, her brilliance did not depend on flattery.

The rejection of worldly glory, implied by her abdication, is succinctly summed up in one of Soldani's reverses showing a terrestrial globe surrounded by the motto NE ME BISOGNA NE MI BASTA ("neither necessary nor sufficient for me"). Implied in the motto is Christina's search for a more satisfying reality that was spiritual and philosophical, rather than mundane and material. Yet another reverse shows a winged Victory with laurel wreath and palm branch and the motto VICTORIA MAXIMA ("the greatest victory"), referring specifically to her abdication of the Swedish throne, which she regarded as a spiritual victory over earthly glory. A fourth reverse shows a lion, a cornucopia, and a globe with the motto FORTIS ET FELIX ("strong and joyful").

Christina's project was not brought to completion. Grand Duke Cosimo III, perhaps fearing that Soldani's involvement in the commission would distract him from other duties, recalled him to Florence and then sent him to Paris, where he was introduced to the outstanding French medallists François Chéron (1635–1698) and Joseph Roëttiers (1635–1703). At the end of his visit, in 1682, he returned to Florence.

By the 1680s Soldani's style as a designer of medals, refined through his experiences in Rome and Paris, had reached full maturity, and it was at this point that he carried out some of his best work in the medium. Among his greatest triumphs in this miniature art were the medals he designed in 1684–85 to commemorate members of the Medici family and the Medici court. Among them were his designs for three medals honouring Francesco Redi (1626–1698) of Arezzo, court physician to the Grand Dukes Ferdinando II and Cosimo III, but equally well known as a zoologist, a poet, and a philosopher. One of the medals alludes to his poetic gifts, featuring an allegorical reverse of a Bacchic revel with the motto CANEBAM ("I was a poet"); another, with a reverse showing an allegory of Health with the motto SALVTI, records his renown as a physician; the third medal, celebrating his renown as a philosopher, shows on the reverse a female figure, possibly one of the Fates, handing a laurel wreath to Minerva, goddess of wisdom; around the circumference of the medal runs the inscription AERE PERENNIVS ("more enduring than bronze").

Soldani used the same obverse for all three of the Redi medals. It is one of his best and certainly one of his most sympathetic portraits, far exceeding in excel-

EBERHARD OTTO

EBERHARD OTTO

Above: Medal of Francesco Redi (Diam. 8.7 cm).

EBERHARD OTTO

Right: Wax mould of a medal of Vincenzo Viviani (Diam. inside mounts 7.6 cm).

lence an earlier medal of Redi that he had designed in 1677. Redi is shown with long, shoulder-length, curling hair, a fashion typical of the period, and in the ubiquitous mantle recalling the draperies of classical portrait busts. Redi's shirt is open, and the portrait, though it uses some of the conventions of formal portraiture, suggests a sitter who is relaxed and at ease. The brilliance of the design is evident in the animation of every detail; it vibrates with life, radiating an inner vitality. With such designs, Soldani raised the Italian baroque medal to its highest levels of artistic achievement.

Bronze specimens of Soldani's medals are well known. Less frequently encountered—in fact, of the greatest rarity—are the preliminary wax designs for them. Among these rare examples are a 1682 design for a portrait medal of Louis XIV, of which both a wax model and bronze casts of the obverse and reverse exist, and the wax models for the obverse and reverse of a medal of Vincenzo Viviani (1622–1703), of which no other specimens or variants are known. The obverse does not refer specifically to Viviani, but the inscription and the similarity of the portrait to other portraits of Viviani make it quite clear that he is the subject. Viviani, the last pupil and the biographer of the great astronomer Galileo, was First Mathematician and Architect to the Medici court. The allegorical scene on the reverse shows a figure with compasses in hand; on the left is a trumpet, and above are cloud-forms with signs of the zodiac.

The obverse, which is signed "M.S." with the date 1685, shows the same kind of animation of surface that characterizes the Redi medals, and the same kind of calculated informality of pose suggested by the open collar. As with all Soldani's designs, a great wealth of precise detail is executed on an extraordinarily small scale.

Soldani was a remarkably versatile artist. His bronzes range in scale from monumental sculptural tombs (for example, those of Marcantonio Zondadari and Manoel de Vilhena at Malta, dating from the 1720s) to his relief designs for coins and medals. He was equally at home designing bronze reliefs, altar decorations, and statuettes. It is his medals, however, that are the cornerstone of his art. As a medallist he knew no peer. His medals—he designed more than fifty-six—are among his most fascinating and compelling works. They are truly masterpieces in miniature.

BILL ROBERTSON, ROM

K. Corey Keeble is associate curator in the European Department of the ROM. After receiving his undergraduate degree in English and history from United College (now the University of Winnipeg), he spent two years in England on postgraduate work at the Courtauld Institute of the University of London. Although interested in 15th- and 16th-century armour and German Late Gothic panel painting, Mr. Keeble now concentrates his studies on Renaissance and baroque bronze statuettes and terracottas.

ROM

It is our pleasure to invite you to attend The Celebration Ball on Thursday, December 2, 1982, to commemorate the reopening of the Royal Ontario Museum.

The Members' Volunteer Committee of the ROM is staging this major event in the majestic new Exhibition Hall. Cocktails, a magnificent dinner, and dancing will be combined to create an unforgettable evening. Proceeds from the $250.00 per person ticket will be contributed to the Museum's continuing development. A portion of each ticket will be tax deductible.

Please indicate your interest in receiving an invitation by telephoning 978-3704 or writing to: The Membership Office
Royal Ontario Museum
100 Queen's Park
Toronto, Ontario M5S 2C6

The Invertebrate Palaeontology Gallery

Desmond H. Collins
Curator
Department of Invertebrate Palaeontology

A visit to the invertebrate palaeontology gallery is a journey through time. Individually, invertebrate fossils are drab-coloured lumps of rock, arranged in a comprehensive, chronological succession, they present an unparallelled panorama of the development of life from its earliest microscopic beginnings in the sea to the incredible variety of today. This panorama is given life and colour by setting the fossils alongside their living descendants.

The use of sea-water aquaria is just one of the display techniques being tested in this experimental gallery, for later use, if successful, in the new Terrace Galleries. Another is the use of invertebrate fossils as decorations, as in the attractive cephalopod grille at the entrance and the polished cephalopod slabs in the gallery. A third technique is the use of models, beginning at the entrance to the gallery with the diorama of life in the tropical Ontario sea, which covered Toronto 440 million years ago.

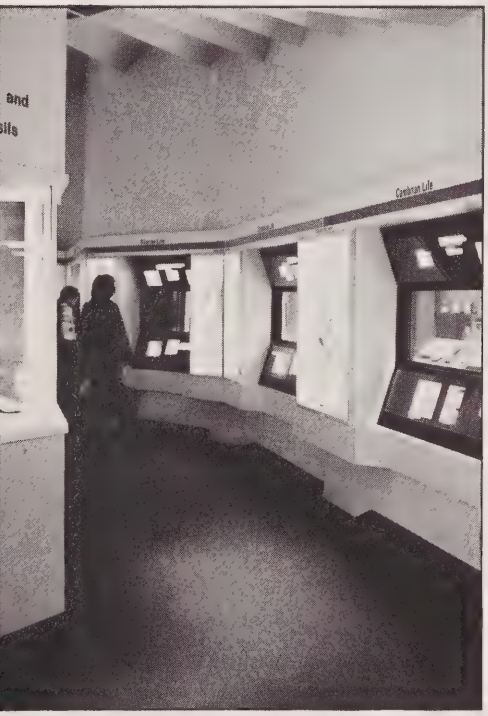
Two concepts dramatically illustrated in the invertebrate palaeontology gallery are those of geological time and evolution. The visitor abruptly meets these concepts when he steps beyond the Toronto diorama and travels three and a half billion years into the past to the first known definite sign of life on earth—layered structures known as stromatolites, formed by colonies of bacteria and algae. Step by step from this unspectacular beginning, each major evolutionary event leading to mankind is documented.

The Precambrian exhibit displays fossil remains left by bacteria and algae, microscopic organisms that dominated life for three billion years, or six-sevenths of the earth's history. Two-billion-year-old stromatolites from Great Slave Lake, Northwest Territories, and living stromatolites from Shark Bay, Western Australia, typify the most common Precambrian fossils. Since our knowledge of Precambrian life and environments is increasing at an exponential rate, the Precambrian exhibit in the Terrace Galleries will probably be much more extensive.

The fossil record becomes much less incomplete at the end of the Precambrian. Each of the next five exhibits follows a three-part pattern; two flanking panels carry fossils representative of the period, while the large central area highlights a particular fossil fauna. The first of the five shows late Precambrian life, including a panel of impressions of soft-bodied animals from Cape Race, Newfoundland—the only display in the world of this fauna. The second, the Cambrian, presents the best display in Canada of Canada's most famous fauna,

Below, left: View into the gallery showing display units in chronological order illustrating progressive development of life through time.

Below, right: Display of living invertebrates in a sea-water aquarium, backed by models of their Ordovician ancestors, and with headings, brief text, and illustrations above and below.

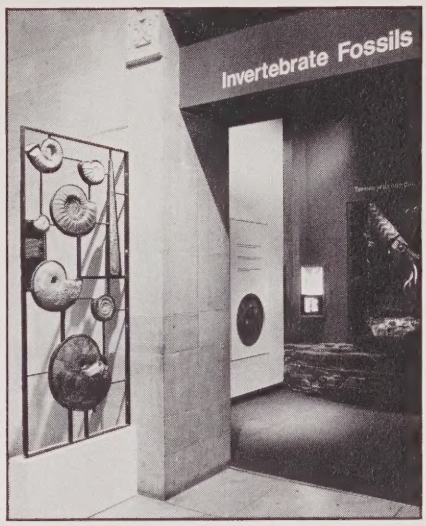


ROM PHOTOGRAPHY DEPT.

which comes from the 540-million-year-old Burgess Shale, a locality recently designated by UNESCO as Canada's fifth World Heritage Site. Next comes the Ordovician, with a famous fossil fauna from Kirkfield, Ontario. This is illustrated by specimens and by a sea-water aquarium of living invertebrate descendants backed by models of the reconstructed fossils. The following diorama, the Silurian, is composed of fossils from Fossil Hill, Manitoulin Island, with rippling light simulating an undersea setting. Last of the five, the Devonian display highlights both an extraordinary fossil fauna from Germany, best seen with x-rays, and the highly fossiliferous Hamilton Formation of Arkona, Ontario, illustrated by an aquarium of living descendants backed by the Arkona fossils themselves. Following the successful rearing of a live nautilus at the Museum last year, the Devonian aquarium will be chilled this year to enable us to maintain more of these marvellous molluscs.

The exhibits that follow are the dioramas and conventional displays of fossils, with brief presentations of two major extinctions and of the evidence provided for continental drift in the southern hemisphere by 250-million-year-old plant fossils. The displays conclude with a case of 6-million-year-old white molluscs, which fluoresce their original colour bands under ultraviolet light, and a mirror that shows the visitor the latest product of evolution.

For most displays, the major evolutionary developments are headlined. For the more curious visitor, the highlighted displays carry in-depth explanations. In exhibits open to the public before the Museum closed, this two-level text was particularly effective. The gallery was rated highly by visitors, most of whom recognized its chronological sequence and understood the progressive development of life through time. Displays using new techniques, especially the aquaria, provoked the greatest interest. The interim gallery reopening this winter will provide further opportunity to refine these successful new techniques, so that the visitor to the future exhibit in the Terrace Galleries will truly be able to retrace each giant step from microbe to man.



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Above: Fossil cephalopod grille and Toronto diorama at the entrance to the gallery.

Dusting Off the Dinosaurs

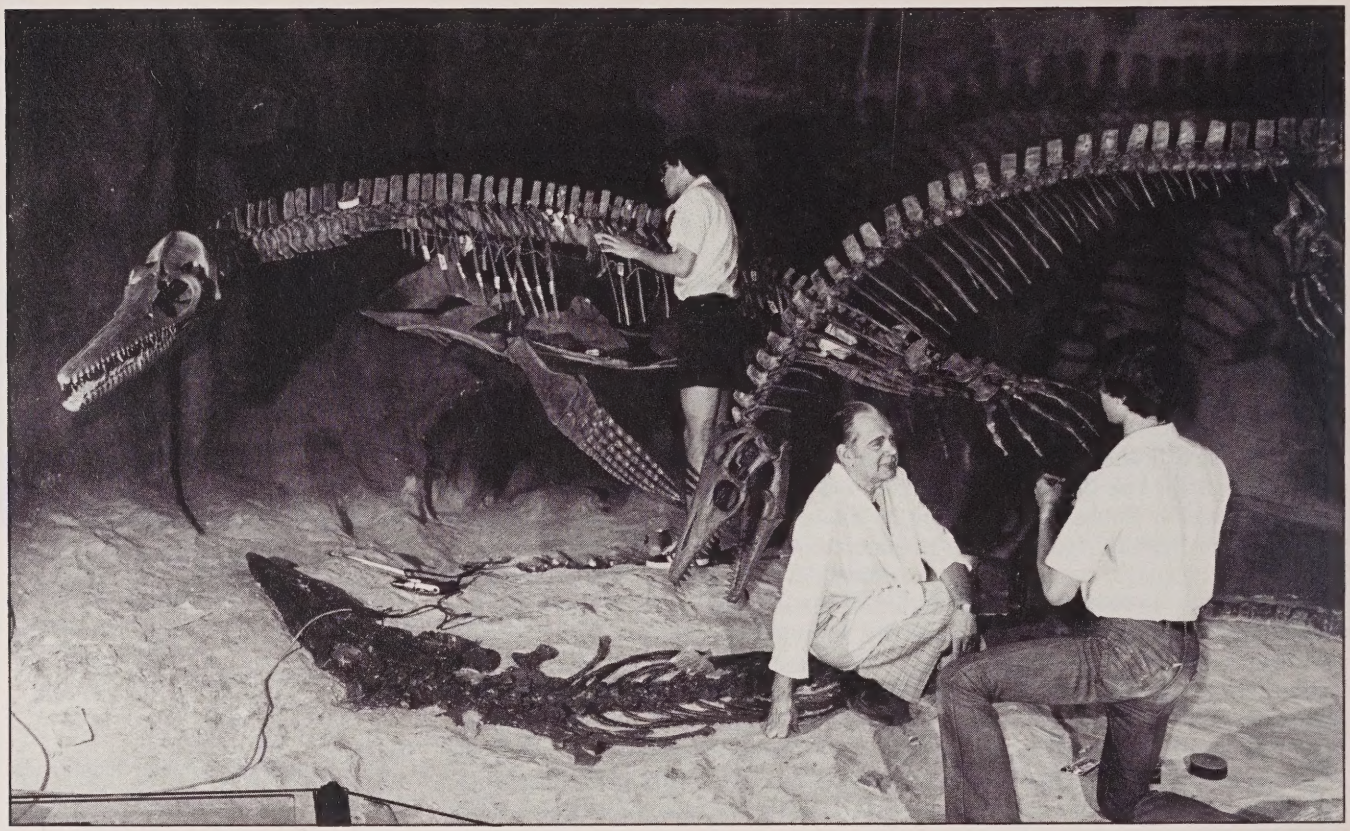
A. Gordon Edmund
Curator
Department of Vertebrate Palaeontology

The vertebrate palaeontology galleries were the only displays not demolished in the renovation of the existing Museum building. We were told how lucky we were—we'd only have to dust off the specimens and touch up the paint. Unfortunately it hasn't been that simple.

Air-conditioning ducts, sprinkler pipes, electrical conduits, and other mechanical necessities were installed, with the expected rain of construction dust and debris. Although the contractors accomplished their work with essentially no damage to the specimens, when work began on the clean-up and touch-up, it became evident that this was going to be a big job. The displays are from ten to fifteen years old and have suffered from lack of climate control. Hairline cracks in the painted jungle backgrounds revealed the existence of large areas of loose plaster that had to be replaced and repainted. Every skeleton had sustained some damage over the years—a lost toe, a broken tooth, a rib come adrift.

The big cleaning job was done by a temporary crew of university students, four of them from this year's class in vertebrate palaeontology. They removed all the foreground vegetation—artificial ferns, cycads, and trees—and washed it in huge tubs of detergent. The tanbark, dozens of bags of it, was vacuumed up from around the dinosaurs' feet, then taken outside to be screened and freed of popcorn and pistachio shells. Next the skeletons were brushed and vacuumed and finally washed, bone by bone. Reaching all the bones in a crowded dinosaur diorama requires remarkable care and dexterity.

While this was happening, others were restoring the artwork, modifying some of the "rock" walls, cleaning the smaller display cases, changing all the light bulbs and fluorescent tubes, and on and on. New labels and graphics were designed and fabricated, a new case featuring recent acquisitions was added, new colours were chosen for walls, ceilings, and carpet. What had seemed at first to be a simple job rapidly became a major undertaking.



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Above: Students Wasyl Sydorenko and Jim Riosa help Dr. Edmund (centre) repair skeletons in the marine reptile diorama.

The lighting received special attention. To conserve electricity and simplify maintenance, the theatrical lights were replaced with modified track-lighting units. At the same time new tapes, film strips, and slides were prepared for the audiovisual units.

Finally came the job of putting it all back together again. The big palm fronds, which had drooped badly over the past ten years, were reassembled and mounted on the trunks. Smaller trees, cycads, ferns, and other vegetation were put in place and primped up, and finally the ground cover of stones, tanbark, and small plants was added. The audiovisual units were reinstalled and tested, and the sound-effects machines were adjusted for level. All of this was going on while the walls were being painted and the carpet laid. As the scheduled opening date approached, more and more "little" problems arose—a dark area needed more light, a scuffed tree trunk required a touch-up, and one of the tape decks developed a hum. The whole project assumed the atmosphere of being backstage just before opening night. The great dinosaur dust-off turned out to be a major spring cleaning.

The results have been worth the effort. The dioramas are fresh again, some of the old displays have been changed, and with the new climate control system the dinosaurs should be good for a few more centuries.®

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